ELECTRICAL REVIEW

ILLUSTRATED.

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VIEWS, NEWS AND INTERVIEWS.

Mountain humor is sometimes rather rocky, especially Rocky Mountain humor, not only in being different from plain humor, but in other respects as well. Here is the Denver *Times* indulging in the following terrible attempt: "Electric cars in Philadelphia seem strangely inconsistent. The 'first families' cannot afford to patronize anything that sounds so fast as 'electric cars.' By the way, are there any 'second families' in Philadelphia society?" It is a current belief in Philadelphia that all of her "second families" became extinct by emigrating in a body to Denver and other points in Colorado.—*Philadelphia Press.*

Mr. Edison has reached the age of 45. His birthday occurred on the 11th inst.

The plans adopted for lighting the World's Fair buildings and grounds provide for 138,218 electric lamps, of which 6,776 are to be arc lamps of 2,000 candle-power each, and 131,452 incandescent, each of 16 candle-power. The electric lighting wire cost something like $1,500,000, and will be ten times as extensive as was employed at the Paris Exposition. About 22,000 horse-power will be required for the electric plant.

The "Great Eastern" which laid so many Atlantic cables, has been broken up at Milford Haven, England. The task has recently been completed after constant work extending over two years.

The following remarkable story is vouched for by the Philadelphia *Times:*

Hoseman William Wilson, of Engine House No. 7, on Church street, Frankford, is the happy possessor of a Remington rifle, and Saturday afternoon, while killing sparrows for a convalescing grip patient, made a peculiar and wonderful shot. Noticing a sparrow perched on a telegraph wire, he aimed his rifle and fired at the bird. He was standing almost directly beneath the bird when the shot was fired, but, strange to say, the bird remained fixed without showing signs of having been struck or any fear of bodily harm.

Wilson, who is a crack marksman and rarely misses, refused to fire another shot. After the lapse of two hours the bird was observed to be sitting apparently in the same spot. A lineman who was passing that way was induced to climb the pole, when he discovered that the sparrow was pinned fast to the wire, the conical ball from Wilson's rifle having hit a flaw in the wire and torn out a strand about two inches long, which, passing directly through the bird, had transfixed it to the wire.

A curious medical phenomenon was exhibited recently to a clinic of 300 students at the Bellevue Medical College. The subject was Michael B. McCarthy, proprietor of the West End Hotel, at 101 West street. His normal respiration has been, for the last three years, 152 a minute, instead of the normal rate of 18 a minute.

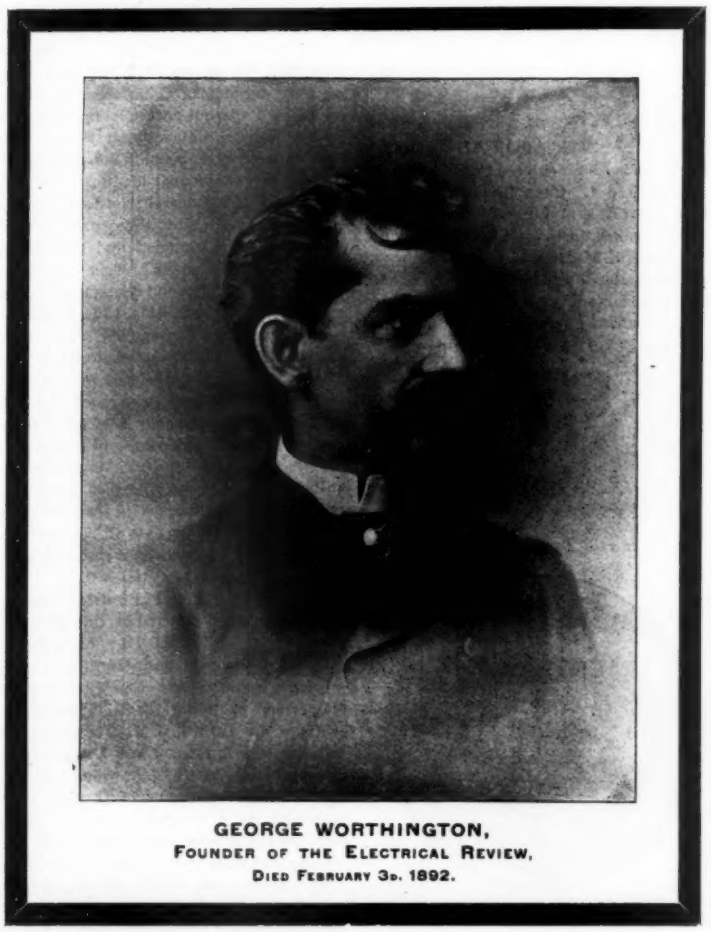
"I was formerly on the police force in Boston," he said. "In the fall of 1889 I was thrown from the platform of an electric car, and landed on the street on the back of my head and shoulders. I became unconscious and remained so for ten days. When I became conscious again I immediately began to breathe like a steam engine under high pressure, and I have continued doing so ever since. I can do no hard work I get out of breath so quickly, and once or twice a month I become suddenly unconscious and remain so for several hours."

The doctors said his trouble was due to an injury to the *medulla oblongata*, caused by the fall from the car. The nerves which control the respiratory organs had been shattered, and had lost all control of the lungs. His case was pronounced incurable, although he may live many years.

During the Franco-Prussian war of 1870, the German Uhlans in particular played havoc with the French telegraph wires; they would cut the connections and carry off the apparatus or else employ it to deceive the enemy. Mlle. Juliette Dodu, a girl of 18, was in charge of the station at Pithwiers when the Prussians captured the place. They confined this young lady and her mother to their dwelling on a higher floor, and it happened that the wire from the office, in running to the pole on the roof, passed by the door of the girl's room. She placed an instrument which she had in her possession in circuit, and obtaining important telegrams of the enemy, secretly communicated them through the sub-prefect of the town to the French commander. This was discovered and Mlle. Dodu was condemned to death, but, the war ending before the sentence was executed, she escaped. Later she was decorated with the ribbon of the Legion of Honor by Marshal MacMahon.

DEATH OF THE FOUNDER OF THE ELECTRICAL REVIEW, MR. GEORGE WORTHINGTON.

George Worthington, the founder and for many years the editor of the ELECTRICAL REVIEW, died at the residence of his brother, in Buffalo, N. Y., on February 3, 1892. Mr. Worthington was probably better known and had a larger circle of acquaintances and friends than any man in the electrical field in this country. His name is almost synonymous with that of electrical development for the past 10 years. He entered the field of his chosen work at a time when it was in a most plastic state, and the evidences of his influence are to-day even more apparent than they were at the time when he first devoted his energy and talents to the furthering of everything that was progressive in the electrical industry.



GEORGE WORTHINGTON,
FOUNDER OF THE ELECTRICAL REVIEW,
DIED FEBRUARY 3D, 1892.

To his efforts, more than to those of any other one man, are due the founding of the American Institute of Electrical Engineers, the National Electric Light Association and the New York Electric Club. To all these organizations Mr. Worthington devoted much time and money, and it is a remarkable fact that he would never, under any circumstances, consent to accept any important office in these societies; but at all times he stood ready and willing, with his personal influence and that of his paper, to help forward any work of these organizations which are now so powerful.

For almost two years past Mr. Worthington's failing health has prevented that active connection with the ELECTRICAL REVIEW which was so marked in previous years. For the last year his health has been in a very precarious state, and, although he had the best of care at his brother's home, near Buffalo, Mr. Worthington's death has been almost hourly expected for three months past.

George Worthington was born in East Bethany, Genesee County, New York, March 18, 1844. He came of good old stock and his family has been prominent in the interior of the State for years. Mr. Worthington attended school at the Genesee and Wyoming Academy, at Alexander, N. Y. In 1862, he went to Milwaukee, Wis., and engaged in the hardware business until April, 1864, when he enlisted in the Fourth United States Infantry and served until the close of the war. After this he returned to Owego, N. Y., and then went to Milwaukee, Wis., where he again entered the hardware business, under the firm name of Worthington & Meek. Subsequently, Mr. Worthington was appointed Consul to Ghent, Belgium. He soon resigned that position and, returning to the United States, went to Pittsburgh, Pa., where he was in the employ of the Pennsylvania Railroad Company for a short time. He then came to New York and entered the employ of W. H. Eldred, of the Gold and Stock Exchange Telegraph Company, and remained there until he founded the ELECTRICAL REVIEW, in February, 1882. From that time until his recent retirement on account of failing health, his every effort was devoted to the building up of the journal which he had founded. Mr. Worthington never married and is survived by his father and brother, Mr. C. G. Worthington, of the insurance firm of Worthington & Sill, Buffalo, N. Y.

The funeral and interment will take place at Bethany, N. Y., during the coming week. This delay is necessary, owing to the illness of Mr. C. G. Worthington.

George Worthington was a well known Mason of high degree, having attained the templarhood of that order. It is an odd coincidence that the death of the founder of this paper should be chronicled in this issue, dated February 13, 1892. The first number of the ELECTRICAL REVIEW made its appearance just 10 years ago, on February 15, 1882. It is a sad ending of a decade during which Mr. Worthington exerted such a marked influence.

CONSOLIDATION.

THE EDISON AND THOMSON-HOUSTON COMPANIES UNITE.

The rumors of the last few weeks regarding the consolidation of the Thomson-Houston Electric Company and the Edison General Electric Company culminated last Thursday, the 5th, when President Villard issued the following circular to the press:

"In response to numerous inquiries from stockholders of the Edison General Electric Company regarding the rumored arrangements between that company and the Thomson-Houston Electric Company, I deem it my duty to inform them that the negotiations in that direction, which commenced last week, are progressing rapidly, and there is every probability that a conclusion satisfactory to all interests concerned will be speedily reached.

"Ever since I organized the Edison General Electric Company I have had the conviction that very great advantages to the stockholders of both corporations and to the public could be secured by bringing them together, through greater economy of the management and the combination of the technical skill and experience which they comprise.

"Nearly two years ago I used my best endeavors to bring about such a result, and, after long negotiations, an agreement was reached, but failed for reasons which do not any longer exist.

"The parties to the present negotiations have all but agreed upon a basis that seems fair and just to both sides, and the stockholders of both companies will probably be invited at an early date to accept them."

The details of the consolidation have not yet been fully completed. It seems pretty certain that Mr. Villard will retire from the presidency of the Edison Company, and it is reported that Vice-President C. A. Coffin, of the Thomson-Houston Company, will be made president of the new organization, which has not yet received a name. The consolidation, it is reported, will be made on a basis of $100 a share for Edison stock and $60 a share for Thomson-Houston stock. Both stocks have been active pending the final arrangements.

It is claimed that this concentration of forces will reduce expenses, lessen competition and stop rate cutting, while the consumer will not suffer from an advance in prices.

Following is the proposed stockholders' agreement appointing a committee to carry out the plan for consolidating the Edison General Electric Company and the Thomson-Houston Electric Company:

Whereas, It is proposed to form a corporation authorized, among other things, to manufacture, develop and use electricity and electrical apparatus and to acquire patents, and for the transaction of business properly connected therewith or incident thereto, such corporation to have a capital stock of $50,000,000, divided into 500,000 shares of $100 each, of which not more than 20 per cent. may be preferred stock, entitled in each year to receive dividends amounting to seven per cent. cumulative, but without any further right of participation in the profits, and without preference as to principal, such corporation, for the purposes of its business, to have the right, among other things, to acquire stock, property and rights of other corporations or individuals.

And certain stockholders of the Edison General Electric Company, of New York, or of the Thomson-Houston Electric Company, of Connecticut, being willing and desiring to the extent indicated in the several subscriptions hereto, or by their deposit in conformity herewith, as hereinafter provided, to promote and participate in such corporation; now each of them hereby agreeing for himself and not for any other, they do hereby mutually promise and agree as follows, viz.:

1. Each subscriber will deposit with The New York Guaranty and Indemnity Company, of New York, or the Old Colony Trust Company, of Boston, as a depositary, in exchange for suitable trust receipts, the number of shares of stock indicated and described in his subscription hereto. All stock deposited hereunto shall be held, used, and applied for the purposes of this agreement. In case a majority of the stock of the Edison General Electric Company, and also of the Thomson-Houston Electric Company shall not have become subject to this agreement on or before May 1, 1892, either by subscription or by a deposit of stock on the terms and for the purposes herein specified or by both such subscription and deposit, or in case this agreement shall have been declared terminated, as hereinafter provided, then and in either of such events the respective depositaries shall return to the holders of the receipts issued by them respectively the stock represented by such receipts or an equal amount of like stock.

2. After such stock shall have been deposited on the terms and for the purposes of the agreement, the said depositaries shall transfer and deliver the same to such new corporation for account of the holders of such trust receipts therefore in exchange for full paid shares of its stock at the par value thereof, in the manner and at the rate following, to wit:

a Shares of the stock of the Edison Company shall be exchanged in full payment for shares of common stock in the new corporation, share for share.

b Shares of preferred stock of the Thomson-Houston Company shall be exchanged in full payment for shares of preferred stock of the new corporation, at the rate of four shares of the old stock (par $25 each) for one share of the new (par $100 each).

c Shares of common stock of the Thomson-Houston Company shall be exchanged in full payment of common stock of the new corporation at the rate of five shares of the old stock for three of the new.

The new stock shall be delivered to the holders of trust receipts for the old stock at the rates above stated upon surrender of such trust receipts. All dividends hereafter declared on account of any deposited stock shall be treated as belonging to and part of such stock.

After the issue of the stock of the new corporation, as required for the purposes above stated, further issues shall be made only for the general purposes of the company.

3. This plan, so far as concerns the subscribers, and any and all stock deposited hereunder shall be carried out under the direction of a committee to consist of the following persons: J. Pierpont Morgan, D. O. Mills, H. McK. Twombly, Frederick L. Ames, T. Jefferson Coolidge and Henry L. Higginson. Such committee is hereby authorized and empowered to act by a majority to fill vacancies and to devise and carry out such measures as it shall in its discretion select to accomplish the purposes of this agreement, including the formation or organization of such a corporation and the selection of its corporate powers; and with power to decide as to all questions arising under this agreement and for the purpose of carrying out this agreement to direct the transfer by the depositaries of the stock deposited hereunder and to transfer to the name of itself or its nominee all trust, all such stock, with the right to vote thereon. No member of the committee shall be liable except for gross negligence on his own part. The committee shall also have power, by the unanimous vote of all its members, at any time before the actual exchange of deposited stock for new stock, to declare this agreement terminated, and thereafter it shall cease to be operative.

4. Instead of a new corporation, any existing corporation may, in the discretion, of the committee, be selected and reorganized so as to provide for the substantial accomplishment of the purposes of this agreement, and in that event the exchange of stock shall be made in the ratio above provided. The committee may also fix and publish a date, after which no stock or stockholder not theretofore party hereto shall have any right to come in under this agreement, except by express permission of the committee on such terms as it may impose.

5. Each subscriber hereto shall deposit stock hereunder within ten days after a notice calling for such deposit shall be published by the committee in one paper of general circulation in the city of New York, and one in the city of Boston, and in default of such deposit the rights of such subscriber shall, at the discretion of the committee, cease and determine.

6. This agreement may, for convenience, be signed in several parts and copies by the subscribers hereto, with like force and effect as if all the signatures were put to one copy thereof. The deposit of stock and the acceptance of trust receipts shall constitute such depositors parties hereto with the same effect as though they had signed this agreement.

Decree in Favor of the Brush-Swan Electric Company.

A decree has been entered by United States Judge Alfred C. Coxe in the suit of the Brush-Swan Electric Light Company of New England against the Brush Electric Company. The cross-bill of defendant was dismissed, and the Judge decided that on October 15, 1890, complainant was entitled to receive from defendant, upon an accounting, the sum of $18,516.62, which amount was ordered paid. Complainant was also adjudged entitled to retain the sum of $10,725.49, paid to it prior to October 15, 1891, by defendants, as a condition of being permitted to make sales.

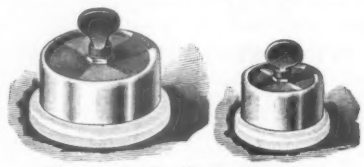
FIG. 1.—EDISON SPECIAL RATCHET SWITCH.

A permanent injunction was also issued against defendants, enjoining them from selling any dynamo, electric machines or apparatus, whether for electric lighting, electroplating or otherwise, except in Manhattan Island, Boston, Albany, Bridgeport, Philadelphia and Baltimore, and except for government use on the Atlantic coast and Long Island Sound.

The decree has been appealed from and the injunction is suspended pending the appeal.

New Edison Switches.

We had occasion recently to describe the advance in the manufacture of small electrical appliances made by the Edison General Electric Company, and devoted some space to acquainting our readers with certain novelties in sockets which they had, within the last month or two, put upon the market. The development, however, in the manufacture of sockets is not the only line on which they had been working. Small switches, for use in private houses, public buildings and elsewhere, have also claimed their attention. Pioneers in the manufacture of these small switches, they have gradually



FIGS. 2 AND 3.—EDISON RATCHET SWITCHES.

improved them, both in certainty of action, in mechanical finish and in the quality of the porcelain used as an insulator in their construction, until one could hardly recognize the model of 1892 when compared with that of 1885. The ratchet switches made by the Edison Company are known and used wherever electricity is used for light or power. Quite recently, improvements have been made in these switches which render them as nearly perfect as ratchet switches can be made. Entirely new switches have been devised to meet the ever growing demand for small and effective ratchet wall switches. These are of 5 and 10 amperes capacity single pole. The bases and ratchets are of hard vitreous porcelain, manufactured by the Edison Company, at Schenectady. The ratchet is of peculiar construction, its sides being of unequal length. When the switch is "on" the shorter sides of the ratchet are presented to the contact brushes. These sides are rounded and the brushes specially curved, so that when the contact is made, the brushes and contact sides of the ratchet fit with precision, thus forming a perfect contact. The ratchet itself is made of the best insulating material known. These switches are rendered instantaneous by an improvement introduced into the ratchet face. The cover is of metal which can be finished in any color and is, therefore, peculiarly suitable for use in houses and buildings where artistic interior decorations are desired. The ratchet is removable and can be discarded in case of accident and another substituted without destroying the entire switch.

The Edison General Electric Company have also adapted their whole line of ratchet switches to the special use of hospitals, asylums, steamships and elsewhere, where it is inadvisable to have other than responsible persons operating them. These special switches are furnished with a small collar fitting outside the cover and firmly screwed down upon the ratchet pin, which cannot be turned except by means of the key in the possession of a competent party. These switches will meet a great demand and have already met with gratifying success.

The Schenectady works of the company have been compelled by the ever increasing demand for their ratchet switches, to enlarge considerably the department in which they are manufactured, and the facilities now possessed for turning out these switches are perhaps greater than those possessed by any other manufacturers of similar appliances in the world.

At the last meeting of the Advance Club, of Providence, R. I., Mr. Homer M. Daggett, Jr., president of the Inter-State Street Railway Company, delivered a very interesting address on the subject of rapid transit for cities, giving a very complete description of the railway of which he is president. He strongly advised electric roads for Providence, as the growth of that city had passed that point where horse railways could give the facilities of travel now required.

The Niagara Falls Tunnel.

The big tunnel was connected at all points on February 5. The 6,700 feet of the tunnel have been excavated, with the exception of the bottom or second bench, which is now under headway, and will require some time yet to complete. Bricking will begin in a few days at the portal and where the last bench is already out.

The New Stanley Laboratory Company.

On the 19th ult., William Stanley, Jr., John F. Kelley, C. C. Chesney, William R. Plunkett, William A. Whittlesey and William B. Tobey organized the Stanley Laboratory Company under the laws of the State of Massachusetts. William Stanley, Jr., has been elected president and Mr. Whittlesey treasurer. The purpose of the company is to devise new applications of electrical apparatus, and the first offer of any patents taken out will be made to the Stanley Electric Manufacturing Company for purchase or manufacture under arrangements with the Laboratory Company. Mr. Kelley, of the new company, is well known in electrical circles, and has been for a number of years the electrician in charge at the United States Electric Lighting Company's factory at Newark. The Manufacturing Company is doing a large business in the Stanley converter and other of Mr. Stanley's inventions. Mr. Stanley is gathering about him some very skilled assistants in his work, and the business of the new concerns seems destined to grow to large proportions.

The Edison Strike.

Walking Delegate Ivory, of the Electric Wiremen's Union, said last Friday that the Union had been successful so far in their fight against the Edison Company without plunging any part of the city in darkness.

"We ordered 13 of the dynamo men out," he said. "At 225 Pearl street the company held out strong inducements to the men, and six of them resigned from the Union and remained. In the other two places superintendents and incompetent men are working the dynamos. They will get along well enough unless something breaks and requires repairing."

The Union declares that it has induced the contractors or architects of all new buildings in the city not to employ any Edison men or use any Edison material. Delegate Ivory is authority for the statement that one of the superintendents of the company is going to start in business for himself and employ as many of the strikers as he can. The officials of the company say they can get all the men they want, and that the light service will not be interrupted.

Moonlight Schedule for February.

The following schedule was calculated on the basis of light one-half hour after sunset and one hour before moonset. Extinguish one hour after moonrise and one hour before sunrise. The schedule obtains for the whole of the United States:

FEBRUARY, 1892.

Day of Mo.	Light.	Day of Mo.	Extinguish.	No. of Hrs.
	H. M.		H. M.	H. M.
1....	P. M. 8.00	2....	A. M. 6.10	10.00
2....	" 9.10	3....	" 6.10	9.00
3....	" 10.30	4....	" 6.00	7.30
4....	" 11.40	.....	.....	6.20
5....	.....	5....	" 6.00	
6....	A. M. 12.50	6....	" 6.00	5.10
7....	" 2.00	7....	" 6.00	4.00
8....	" 3.10	8....	" 6.00	2.50
9....	" 4.00	9....	" 6.00	2.00
10....	No light.	10....	No light.	0.00
11....	No light.	11....	No light.	0.00
12....	No light.	12....	No light.	0.00
13....	P. M. 6.00	13....	P. M. 7.30	1.30
14....	" 6.00	14....	" 8.30	2.30
15....	" 6.10	15....	" 9.30	3.20
16....	" 6.10	16....	" 10.20	4.10
17....	" 6.10	17....	" 11.20	5.10
18....	" 6.10	19....	A. M. 12.20	6.10
19....	" 6.10	20....	" 1.20	7.10
20....	" 6.10	21....	" 2.30	8.20
21....	" 6.10	22....	" 3.30	9.20
22....	" 6.10	23....	" 4.30	10.20
23....	" 6.10	24....	" 5.30	11.20
24....	" 6.20	25....	" 5.40	11.20
25....	" 6.20	26....	" 5.40	11.20
26....	" 6.20	27....	" 5.40	11.20
27....	" 6.20	28....	" 5.40	11.20
28....	" 6.20	29....	" 5.30	11.10
29....	" 6.20	Mar. 1	" 5.30	11.10
			Total.....	184.00

The Crystal Palace Exhibition.

The Crystal Palace at Sydenham is certainly better suited than any other building in this country for the purposes of an electrical exhibition. It is now ten years since the last was held in this building, and during that time so much progress has been made that the exhibitors have a grand opportunity to illustrate the present position of the industry.

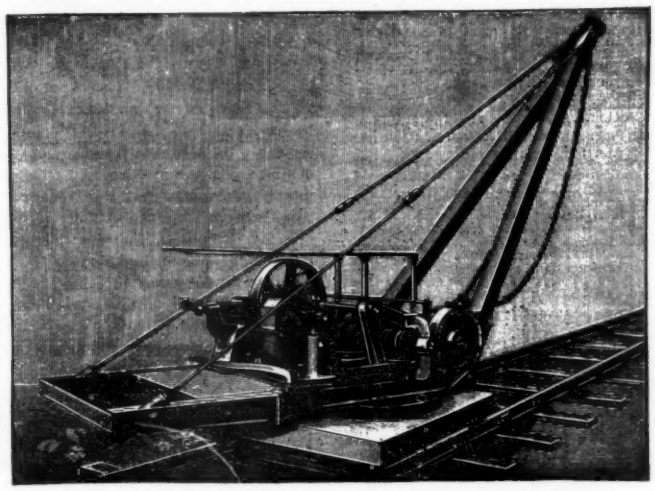
Without any ceremony the exhibition opened on the 8th inst., but many of the exhibits, and more especially in the machinery department, were in a most backward condition. Under the circumstances it is, of course, very difficult to adopt any method of describing what is to be seen, but in a second visit I will trust to view all the stands complete and ready. What first draws the attention is the screen of incandescent lamps exhibited by the Edison-Swan Company. At the end of the North nave there is a wondrous show of light, and underneath is the stand containing a fine assortment of the company's manufactures. Next comes a large and excellent show by the post office, comprising the various apparatus used in telegraphy, from its first introduction in 1837, with the instruments of Cook and Wheatstone, to those of the present time. A complete display of Sir William Thomson's measuring instruments is shown by W. White, of Glasgow. Then we have a most prominent exhibit by the Fowler-Waring Cable Company. Here are found wires of all kinds and descriptions; from fine concentric to the cables for electric lighting and for telegraph and telephone work. Specimens are shown of the cables used for the connection of the London telephonic centers with the Paris telephone cable, and sections of the high tension distributing mains employed by the London Electric Supply Corporation. One of the most imposing and important stands in the exhibition is that of the Brush Electrical Engineering Company. Their exhibits are divided, one portion being in the main transept and the other in the Machinery Hall. In the first the exhibition of dynamos, motors, arc lamps and tramcars commands attention, while in the machinery section, the fact of the machines being labeled precisely similar to those used for lighting the city of London, will attract the greatest attention to the exhibit. There are five sets of engines and dynamos, ranging from the large size used at the city of London Electric Light Company's station at Bankside, to the small 10 horse-power combined plant for lighting private houses. In the main transept an enormous lamp-post built up of tubular plates commands attention, for it reaches nearly to the roof and carries six arc lamps. The Brush Company also show a splendid electric traction tramcar made at the Falcon Works, Loughborough. The Brush Electrical Engineering Company not merely supply, but themselves manufacture, every article and power.

Messrs. Crompton & Company, Limited, have several conspicuous exhibits. There is a projector to throw a stream of vivid light wherever desired, surrounded by the company's dynamos. The electrical crane is driven by a five unit motor, taking 45 amperes and 110 volts. It is rated to hoist two tons at the rate of 80 feet per second. The motor is connected by a friction wheel to an intermediate shaft, which is connected by a spur wheel to the drum shaft. This latter contains a clutch to throw the drum in or out of gear. A powerful band brake is provided on the drum, and is worked by a treadle. The slewing is done by intermediate gearing from the intermediate shaft, and is controlled by a hand lever conveniently placed. The crane is made to travel by the movement of a hand wheel in a manner similar to that by which the operation of slewing is carried out. It is fitted with Crompton's patent sight-feed lubricators and all the latest improvements. Current is supplied to the crane by two rails, along which are laid copper strips. The rails are carried on Crompton insulators, similar to those used in his underground mains, and are laid between the traveling rails. The current is taken off by an improved form of collector gearing with carbon brushes. A double pole switch and fuse are interpolated in the circuit. The crane will be exhibited at work at certain stated times during the exhibition.

Then we find the Western Electric Company's stand with all telephonic requirements. The National Telephone Company have another most interesting feature in a concert room, where, on payment of a small sum, one can listen to music which is being performed at theatres in London, Birmingham, Manchester and Liverpool.

In the boiler department Messrs. Davey, Paxman & Company are supreme. To supply the steam for driving the engines working in the exhibition, there is a battery of eight steel locomotive type boilers, containing a total heating surface of 5,640 square feet. One of Paxman's patent new type water tube boilers is also shown and contains about 1,572 square feet of heating surface. The boiler is made on a new principle, automatically separating any water in the steam. The joints are on Paxman's & Plane's patent metallic principle and the boiler is made in sections readily removable. The joint referred to is very simple, but most serviceable and is likely to be quickly taken up for other kinds of boilers. The joint has the following advantages, it is easily broken and remade and when made is perfectly tight. The greater the pressure inside, the tighter the joint, as the pressure assists in making it so. It is most lasting, the metallic cover being almost indestructable and the boiler can very easily be taken to pieces for examination. Messrs. Davey, Paxman & Company are willing to grant licenses to all makers of tubular boilers and the advantage is likely to be made great use of. Messrs. Crossley have also a goodly show, but that I will notice in a succeeding letter. The General Electric Company have a fine exhibit of switches and general fittings, and also show motors at work and electric heaters for curling irons and other toilet and domestic purposes.

Messrs. Woodhouse & Rawson United, Limited, have a fine stand which I shall notice further later on. There is a Kingdon dynamo and a novelty in the shape of an electro-hydraulic riveter. There are also a number of Midget arc lamps. Messrs. Dorman & Smith show switches; Mosses & Mitchell their vulcanized fibre, and Davis & Timmin's nuts and screws.



CROMPTON'S ELECTRICAL CRANE, EXHIBITED AT THE CRYSTAL PALACE EXHIBITION, LONDON.

The recent fire at Messrs. Laing, Wharton & Down, has thrown them greatly behindhand, as switchboards and artistic fittings to the extent of several hundreds of pounds had been prepared and were ready for delivery at the exhibition. Messrs. Siemens Bros. show two huge dynamos from the Naval Exhibition, with switchboards ready fixed. The Gulcher Company, who now have the contract for lighting the Crystal Palace, for their exhibit have removed all the old machinery and installed a new plant. There are two 40 unit dynamos supplying incandescent and arc lamps on the low tension parallel circuit, and a 30 unit alternator of the newly designed Fricker type. They are driven by Galloway boilers and the Crystal Palace engines. In the galleries the most noticeable exhibit is that of Messrs. Rashleigh, Phipps & Dawson, who have one of the largest spaces in the exhibition. There are a number of rooms and a conservatory fitted up most handsomely—one an old English hall, another an Italian dining room, and the last a Japanese drawing-room. There are some novel and striking electric light effects and the exhibit is a very popular one.

CHARLES FFRENCH.

London, January 30.

Another Electrocution.

The sixth electrocution under the New York State law took place at Sing Sing on Monday, February 8, about 11 o'clock A. M. The criminal was a brutal murderer named Charles McIlvaine. After two applications of the current the victim was pronounced dead. Several newspaper reporters were present, Governor Flower having signed the requisite amendment to the law on the 4th instant.

Misappropriation of Funds Claimed.

R. T. McDonald, treasurer of the Fort Wayne Electric Company, which, as a stockholder of the Manhattan Electric Company, of New York city, has petitioned the Attorney-General for permission to sue Charles C. Bernheim and others, trustees, for misappropriation of funds, explains the suit by saying that the trustees have lent $190,000 to the Harlem Lighting Company, and which Mr. McDonald says is insolvent. The trustees say that their action is justifiable, and that the loan is perfectly safe. Minority stockholders in the Harlem Company are asking for a receiver on the ground that Bernheim and his associates have mismanaged the concern and issued $65,000 in notes for $52,000 and have ruined the Company. The trustees say that it is worth more than when they took hold of it.

Across the Continent Once Every Week.

The management of the New York Central & Hudson River Railroad Company announce the inauguration of through sleeping car service over the Vanderbilt Lines and their connections, between New York and Boston and the Pacific coast. Heretofore the traveler making the journey in either direction has been obliged to transfer at Chicago, St. Louis, or the Missouri river gateways, but under the new arrangement he can occupy the same car through from starting point to destination without any additional expense, and be relieved of the necessity of changing cars, looking after connections, reserving accommodations from point to point, and other troublesome details of a trans-continental trip.

Commencing January 5, 1892, and on each Tuesday thereafter until April 19, inclusive, a palace buffet sleeping car, containing 12 sections of two double berths each, a drawing-room and buffet, will leave Grand Central Station, New York, on the North Shore Limited at 4.50 P. M., and run through to San Francisco without change or delay at junction points. Connecting train wil leave Boston at 2.15 P. M.

The schedule has been so arranged that the car will be carried through on fast express trains equipped with dining cars, so that regular meals may be had in transit or à la carté in the buffet car, as may be desired, a feature that will be appreciated by ladies and children. Luncheon and the choicest wines and cigars will be served from the buffet at all hours.

The several routes have been carefully selected with reference to their scenic attractions, in order to afford tourists every opportunity for witnessing the great natural wonders of the continent, its principal cities, interesting physical and political divisions, etc.

The acceptance of both one-way and return tickets gives tourists the benefit of a through service without requiring the prepayment of a sufficient sum to cover all expenses contingent on a trip of several weeks' or months' duration. Passage and berth tickets only being required, all other expenses while in transit or sojourning in California are left discretionary with the traveler, who is thus enabled to go and come at pleasure, patronizing such hotels and lines as may best suit his convenience.

A special conductor will accompany the car on each trip, and do all in his power to insure the comfort and pleasure of passengers. He will be assisted by a porter and a buffet attendant.

New York City.—Universal Power Company; capital, $15,000.

Long Branch, N. J.—Electrical Conduit Company; capital, $300,000.

Portland, Ore.—The Sanders Electric Light Company; capital, $200,000.

New York City.—International Type Telegraph Company; capital, $2,000,000.

Waterloo, Ia.—Waterloo-Cedar Falls Construction Company; capital, $200,000.

Apollo, Pa.—Apollo Electric Light, Heat and Power Company; capital, $20,000.

Bartow, Fla.—South Florida Electric Company; capital, $2,500. Promoters, C. J. Seegar, F. J. Maywald and W. E. Prince.

Logan, O.—The Logan Telephone, Water and Light Supply Company; capital, $25,000.

Salem, Ind.—The Salem Electric Light and Artificial Ice Company; capital, $15,000.

Somerset, Pa.—Somerset Electric Light, Heat and Power Company; capital, $12,000.

Denver, Colo.—The People's Manufacturing and Investment Company; capital, $100,000.

Lock Haven, Pa.—Clinton County Electric Light, Heat and Power Company; capital, $25,000.

Monte Vista, Colo.—The Amethyst Water Works and Electric Light Company; capital, $100,000.

Philadelphia, Pa.—Strohm Automatic Electrical Safety Block System Company; capital, $5,000,000.

Deposit, N. Y.—Deposit Electric Company; capital, $12,000. Promoters, C. M. Putman, C. H. Putman and Charles Knapp.

Spokane, Wash.—Washington Brick, Lime and Manufacturing Company; capital, $50,000. Promoters, Joseph H. Spear and Henry Bork. Incorporation papers sent to Joseph H. Spear, Spokane, Wash.

Ephrata, Pa.—The Ephrata Light Company; capital, $10,000. Promoters, John F. Mentzer, Andrew Bahn, Charles Wise, all of Ephrata, Pa. Incorporation papers sent to Hon. W. U. Hensel, Lancaster, Pa.

Doylestown, Pa.—The Doylestown Electric Company; capital, $16,000. Promoters, Alfred Paschall, Wm. H. Kirk, Frederick Tibbits, all of Doylestown, Pa. Incorporation papers sent to Henry Lear, Doylestown, Pa.

Findlay, O.—The Hancock Light and Power Company; capital, $25,000. Promoters, Charles F. Smith, James A. Bope, Wm. C. Neibling, Vincent H. Coons, Linden R. Clark. Incorporation papers sent to Charles Smith, Findlay, O.

Millville, N. J.—Millville Electric Light Company; capital, $50,000. Promoters, Francis Ruvis, H. B. Kemble, of Millville, N. J., and Walter Wood, Philadelphia, Pa. Incorporation papers sent to Walter Wood, 400 Chestnut street, Philadelphia, Pa.

Lock Haven, Pa.—Clinton County Electric Light, Heat and Power Company; capital, $25,000. Promoters, Charles M. Blanchard, Charles M. O'Connor and E. B. Shoemaker. Incorporation papers sent to Henry C. Terry, Bullitt building, Philadelphia, Pa.

Massillon, O.—The Massillon Light, Heat and Power Company; capital, $150,000. Promoters, J. Walter McClymonds, Joseph K. Russell, George L. Russell, Warren E. Russell, Allen A. Russell and C. M. Russell. Incorporation papers sent to C. M. Russell, Massillon, O.

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CONTENTS.

	PAGE.
Views, News and Interviews	327
Death of the Founder of the ELECTRICAL REVIEW, Mr. George Worthington	327
Cansolidation	328
Decree in Favor of the Brush-Swan Electric Company	328
New Edison Switches	328
The Niagara Falls Tunnel	328
The New Stanley Laboratory Company	328
The Edison Strike	328
Moonlight Schedule for February	328
The Crystal Palace Exhibition	329
Another Electrocution	329
Misappropriation of Funds Claimed	329
Across the Continent Once Every Week	329
New Corporations	329
The Law of Hysteresis	330
George Worthington	330
The Consolidation	330
Correspondence:	
Our Boston Letter	331
Our Chicago Letter	331
Our San Francisco Letter	331
Our Seattle Letter	331
Seeking Electrical Data	331
Subway Rates and the East River Company, of New York	331
Personal	331
National Electric Light Association	331
Electric Heating	331
Telephonic News	332
Fort Wayne Electric Company's Plant	332
The International League of Press Clubs	333
Telegraphic	333
New York Electrical Society	333
American Institute of Electrical Engineers	333
Mr. Thurber Sues the Jarvis-Conklin Mortgage Company	333
Chicago Electric Club	333
Electric Power	334
Brown & Sharpe's Plain Milling Machine	334
The Graphite Industry	334
Practical Notes on the Reflecting Galvanometer and its Accessories	334
Electric Light News	335
On the Law of Hysteresis	336
Fire at Roebling's Factory	337
Interesting Experiment With Ozone	337
Kindred Interests	338
Electrical Patents	338

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
American Circular Loom Co	i
American Electrical Works	i
Ansonia Brass & Copper Co.	xx
Armington & Sims	xx
Bridgeport Brass Co	xx
Brown & Sharpe Mfg. Co	i
Brush Electric Co	xix
Crocker-Wheeler Motor Co	i
Day's Kerite Insulated Wires	xx
Eastern Electric Cable Co	xx
Eastwood, Benj	i
Eddy Electric Mfg. Co	i
Gleason Mfg. Co., E. P.	i
Hampson & Co., E. P.	xx
Jewell Belting Co	xx
Johns Mfg. Co., H. W	xx
Keasbey, Robert A	xx
Link Belt Engineering Co	i
Moore, Alfred F	xx
National Electric Mfg. Co	ii
Noye Mfg. Co., John T	xx
Okonite Co	i & xx
Schuyler Electric Co	xix
Wainwright Mfg. Co	i
Wallace & Sons	i
Weston Engine Co	i
Wilmot & Hobbs Mfg. Co	xx

INSIDE PAGES.

Allis & Co., Edward P.	x
American Bell Telephone Co	xvii
American Casualty Insurance and Security Co	vii
American Electric Elevator Co	ix
Baker & Co	vi
Ball Engine Co	vii
Barnes Co., W. F. & John	viii
Barrett, John A	338
Belden Mica Mining Co	338
Belknap Motor Co	xvii
Benedict & Burnham Mfg. Co	iii
Bishop Gutta Percha Co.	xi
Brill Co., J. G	ix
Buckeye Engine Co	ix
Burton Electric Co	viii
"C. & C." Electric Motor Co	xii
Cary, Alanson	vii
Central Electric Co	iii
Church & Sleight	ix
Consolidated Electric Mfg. Co	xi
Crane & Co., J. B.	ix
Dixon Crucible Co	xi
Douty, H. W	iii
Dwight Slate Machine Co	viii
Edison General Electric Co	v
Edison Mfg. Co	iv
Electric Secret Service Co	xiii
Electro-Light Engraving Co	viii
Elektron Mfg. Co	x
Empire China Works	x
Equitable Engineering & Construction Co	viii
Evans Friction Cone Co	x
Falls Rivet & Machine Co	ix
Faraday Carbon Co	ix
Fletcher & Fletcher Electric Co	ix
Fort Wayne Electric Co	xviii
Garvin Machine Co	ix
Globe Co	viii
Greeley & Co., The E. S.	xii & xiii
Haines, Jones & Cadbury Co	xvii
Harrisburg Foundry and Machine Works	xi
Heisler Electric Co	xiii
Hill Electric Co., W. S	vi
Holmes, Booth & Haydens	xii
Hummer, Aug	338
Imperial Porcelain Works	xiii
Independent Bung Co	xiii
Ladd, Alfred W	viii
Lane & Bodley Co	vi
Law Telephone Co	338
Leclanche Battery Co	xi
Leffel & Co., James	vii
Lehigh Valley Creosoting Co	viii
Leonard & Co., H. Ward	ix
Lofquist, Hjalmar	338
Marshall, Wm	xiii
McCreary Electrical Specialty Co	viii
Merchant & Co	xvii
National Electric Mfg. Co	xv
National India Rubber Co	x
New England Butt Co	vii
New York Insulated Wire Co	vi
New York & Ohio Co	xvii
New York Belting and Packing Co	viii
New York Safety Steam Power Co	vi
Ostrander & Co., W. R	viii
Paiste, H. T	xi
Partrick & Carter Co	xvii
Phœnix Glass Co	xii
Phosphor-Bronze Smelting Co., Ltd	viii
Prentiss Tool & Supply Co	338
Queen & Co	x
Reddaway & Co., F	ix
Ridlon & Co., Frank	338
Royce & Marean	viii
Sargent, J. B	338
Sawyer-Man Electric Co	xvi
Schieren & Co., Chas. A	338
Schuylkill Foundry and Machine Works	ix
Short Electric Railway Co	x
Solar Carbon and Mfg. Co	xvii
Sonnoff, J. L	vi
Sperry Electric Mining Machine Co	xi
Standard Paint Co	vi
Stanley Electric Mfg. Co	xi
Thomson-Houston Electric Co	xviii
Truex & Vail	ix
Tyndall, Wm. D	vi
Waddell-Entz Electric Co	viii
Walworth Mfg. Co	iii
Washburn & Moen Manufacturing Co	xii
Watson & Stillman	vii
Western Electric Co	xvii
Weston Electrical Instrument Co	xvii
Westinghouse Electric & Mfg. Co	xv
Wheeler Condenser & Engineering Co	vii
Williams & Potter	viii
Woodhouse & Rawson	xiii
Wyckoff, Seamans & Benedict	338

The managers of the electrical department of the World's Fair will, no doubt, see to it that all wild-cat and fakir schemes are religiously excluded. Send the electric hair brush, the magnetic belt and the like devices to the patent medicine department.

Everything is favorable for a large attendance at the Buffalo meeting of the National Electric Light Association on February 23. Special trains will carry members and their friends from New York, Boston, Chicago and Philadelphia. The trip from New York will be an especially enjoyable one, as all the arrangements are in the hands of that veteran traveler, Mr. C. O. Baker, Jr. Those who traveled under his care to Montreal know what this means. The start will be made from New York the morning of the 22d, which is a holiday, so that no business time will be lost on the up trip. The conditions surrounding this meeting of the Association are especially propitious and every one who can should go to Buffalo. All the electrical world and his brother will be there.

The press gag clause of the New York Electrical Execution Act has now been wiped from the statutes and newspaper representatives, in future, will not be excluded from the death chamber; to be sure they are not specially invited nor urged to be present, but it does not prohibit their presence. A full text of the amendment is given in another column, and it will be noted that it omits all the provisions of the law against the publication of details of executions. We shall now be able to get unprejudiced testimony upon the subject of legalized electrical torture.

THE LAW OF HYSTERESIS.

The paper read by Mr. Charles Steinmetz before the American Institute of Electrical Engineers, a third section of which is given in this number of the REVIEW, will prove of value to electrical engineers. The curves and tables were derived from a large number of experimental researches with Mr. Eickemeyer's magnetometer. Mr. Steinmetz' investigation shows that for all frequencies between 28 and 207 complete periods per second the loss of energy due to hysteresis or molecular friction varies according to the 1.6th power of the density of magnetization. The value of this exponent as well as the co-efficient of hysteresis varies somewhat with the frequency, but only to a very slight degree, so that for practical purposes it may be assumed that with a given sample of metal in the magnetic circuit the loss from hysteresis will vary as 1.6th power of the number of lines of force per square inch. From an average of a large number of readings the loss at frequencies of 28, 36, 137 and 205 periods per second varied as 1.6111 x 4.002110, 1.6476 x 4.002315, 1.5337 x 4.002438, 1.6012 x 4.002434, an average of which shows that the hysteresis H = .0024164 $B^{1.6}$, B representing the magnetization per square centimetre or square inch. A further fact of interest shown is that this formula holds equally good for open and closed magnetic circuits, supposing that the magnetic density be the same in the two types of circuit. The losses have been tabulated for magnetic densities varying from 85 lines of force up to 19,340 lines of force per square centimetre, thus covering a range sufficiently wide to answer all practical requirements. The data furnished by his investigations do not, he concludes, agree with Ewing's theory that for small magnetizations hysteresis should disappear, and for medium degrees of magnetization it should increase very rapidly. As noted above, the variation is substantially uniform throughout the whole range of magnetization, from 85 to 19,340 lines per square centimetre. A very neat modification of the magnetometer was used to determine the hysteretic loss for samples of iron not turned to a definite size. In the ordinary use of the magnetometer, the piece of iron to be tested is turned in a lathe to the exact size of a standard bar of Norway iron, and the two pieces are placed in separate magnetic bridges of the same magnetic circuit. If the two are of equal permeability they will carry the same number of lines of force, and will exert equal and opposing forces upon a magnetic needle placed between them. In substitution for the accurately turned sample, the bridges were closed by a Norway sample and the sample to be tested. A coil surrounding the latter sample carried a current which was regulated until both bridges were at the same magnetic potential. The main magnetometer coil was then placed in the circuit carrying the frequency to be tested, and readings taken for different numbers of ampere turns corresponding, of course, to different degrees of magnetization.

The co-efficients of hysteresis for hardened steel, annealed steel, cast iron and magnetic iron ore, are graphically shown in one diagram, and vary from .016 to .035. This co-efficient variation results in a considerable difference in the slope of curve for different kinds of iron or stone.

The paper is one of exceptional value and will doubtless prove of material assistance to engineers engaged in alternate current work.

GEORGE WORTHINGTON.

George Worthington is dead! To those who knew his lovable disposition, his kind and generous heart—to every reader of the ELECTRICAL REVIEW—this brief announcement will bring deep regret. It is with unfeigned sadness that we pay this slight tribute to our dead friend and associate. In his nature there were two prominent characteristics—a deep love for the journal he founded and a constant desire to make every one around him happy. Grief or pain always found in him sympathy and response. His own means and health were often sacrificed that others might see the sunshine. In newspaper work he was quick to discern, far-seeing and an excellent judge of the character and abilities of men; never devoted to the details of the exacting profession of journalism, yet was he quite successful in the broad lines of suggesting means to materially advance the progress of the science and industry his journal was started to represent. For nine years he was editor of the REVIEW. Then, suddenly, his health failed, his mental vigor weakened. A devoted brother's watchful care protected him for 12 long, uncertain months, and then the summons came and in the night of February 3, at Buffalo, he breathed his last.

Although it pleased his Maker to call him to his eternal home before he had finished his life-work, yet he leaves behind him, especially in the electrical field, an influence and a personality which will always be remembered.

THE CONSOLIDATION.

That which has been in the air for the past two years has at length assumed definite shape, and the consolidation of the Edison and Thomson-Houston Companies will soon be an accomplished fact. We are not of those who are ready to cry monopoly, for we believe that the meeting of these great interests will be beneficial to electrical advancement. The public is not liable to suffer in this case any more than it has from the consolidations that have, in the recent past, been effected to the benefit of all concerned. By the lessening of expenses per unit of output and cutting out those losses which are necessary accompaniments of excessive competition, the chances are in favor of a reduction rather than a rise in prices to the consumer.

With Mr. Coffin prominent in the management of the new corporation, the business will be carried on in a progressive but conservative manner, and it is safe to predict that the results will be gratifying to those who are lucky enough to hold stock of the company, whatever its name may be. It would seem a pity, by the way, that any name should be adopted which should not retain those distinctive of the old companies. Let "Edison" and "Thomson-Houston" figure in the new christening.

A bill has recently passed the lower branch of the Ohio Legislature making it unlawful for any unauthorized person to tap telegraph or telephone wires. It is stated that the real object aimed at in this bill as introduced, was particularly to prevent the tapping of these wires to get advance information regarding horse races and other pool-room news, but when the bill came up for passage it was amended so as not to include this class of news in its protection, owing to its unlawful character. The bill was passed with this change. Whilst, of course, it is most desirable to have the State free from the suspicions of protecting gambling in any way, yet the placing of such a law on the statute books is of no avail owing to the loophole which it leaves. The simple act of wire tapping should be sufficient cause for conviction and such is the law in other States, but the attempt to define just what kind of news it shall be unlawful to abstract, makes it, in many cases, impossible to prove a charge.

CORRESPONDENCE.

OUR BOSTON LETTER.

The Mechanics' Charitable Association Building on Huntington avenue, this city, is to be equipped throughout at an early day with a complete electrical outfit for arc and incandescent illumination.

The Massachusetts Electrical Engineering Company, of this city, has been awarded the contract to make plants of, and arrange for the equipment for, the electric illumination of Boston's new court house.

The Telephone Ball.—A thousand merry dancers tripped the light fantastic at the annual ball of the Telephone Employés Mutual Benefit Association in Old Fellows' Hall, this city, on Thursday evening, January 21. There was present many from distant cities.

The Freeman-Holland Company was organized at Portland on January 28, 1892, under the laws of the State of Maine. Capital stock, $500,000. Officers: president, Dwight S. Woodworth; treasurer, Josiah H. Gunning; secretary, Henry F. Holland; vice-president, Eben W. Freeman.

Manager Geo. D. Hall, Jr., of the Wainwright Manufacturing Company, of Mass., reports business in his line as satisfactory, the new year having opened up most encouragingly in the way of many large orders for the Wainwright improved feed water heater. One contract alone calls for 16,000 horse-power.

Car Fenders.—The West End Street Railway Company, this city, has again taken a step in the right direction in testing various car fenders, with the view of putting them on its electric cars. The new 40-foot electric cars now being operated by the road named are equipped with controlling devices which stops the car almost within its length.

Inspection of Boilers.—The Hartford Steam Boiler Inspection and Insurance Company reports that during the month of December, 1891, its inspectors made 6,018 inspection trips, visited 11,667 boilers, inspected 4,717 both internally and externally, and subjected 689 to hydrostatic pressure. The whole number of defects reported reached 10,664, of which 938 were considered dangerous; 46 boilers were regarded unsafe for further use.

The Thomson-Houston Electric Company's railway department is in receipt of another large order from the West End Railway Company, consisting of fifty 25 horse-power W. P. single reduction motors. These machines are to be used on the large double-decked cars—two motors on one of the trucks of each car—and twenty-five of these cars will soon be placed in daily operation on the West End road.

President S. E. Barton, of the Electric Mutual Insurance Company, by attorney, entered in the superior court at Atlanta a plea of guilty of violation of the insurance laws of Georgia on March 2, 1891. The judge imposed a fine and cost which will amount to about $300. This was a case where the Electric Mutual wrote Georgia risks without being duly entered in that State, and has been a matter of great interest to the stock companies which sustain the obligations of the insurance laws.

Another Thomson-Houston Enterprise.—Advices from Lynn, Mass., under date of January 19, state as follows: Plans are now being drawn for the great foundry building of the Thomson-Houston Company, to be located on Western avenue, near the Saugus river. It will have a capacity for making as large castings as are now needed, the possible size of the castings being governed by the limits of transportation facilities. The foundry will be a long desired addition to the facilities of the country.

Worcester, Mass.—At the special meeting of the stockholders of the Worcester Electric Light Company, Thursday, January 21, it was voted to issue $50,000 additional stock, also to issue $100,000 in bonds. The mortgage is to take up the floating debt of the company, and the proposed increase in stock is to increase the incandescent plant with a view to furnishing additional street lamps for the city. It is understood the present stockholders will be given an opportunity to subscribe to the new stock in the proportion of one new share to five old ones.

The contractor is delivering the foundation stone for the 550 horse-power engine which is to be put in at the station on Faraday street. The brick for the foundation has been delivered. The engine will have a 22-inch fly-wheel, which will weigh 53,000 pounds and carry a 62 inch belt.

Boston, February 6. W. I. B.

OUR CHICAGO LETTER.

Cutter's Elastic Tape will be put on the market in a few days by George Cutter, who believes he has a pure rubber compound that will just meet the wants of station men.

Incorporated.—The Chicago & Plainfield Overland Electric Street Railway Company, Chicago; capital stock, $600,000; incorporators, Daniel W. Gale, Edwin A. Moulton and William Cummings.

The Electric Merchandise Company, Chicago, report an encouraging outlook for the coming season's business. Already orders are being booked for large lots of their standard appliances. Its neat and durable equipment is eagerly sought by a large portion of the trade. This company has well prepared itself for every emergency. Increased stock and generally improved facilities place it in excellent condition to meet every demand of its many present and future patrons. The fact that everything in the electric railway line can be obtained at once from this exclusive house is well understood and appreciated by roads in all parts of this country.

The Central Electric Company report having on hand a large stock of the supplies manufactured by the Interior Conduit and Insulation Company, New York, and are consequently enabled to fill all orders for these materials with exceeding promptness. The Banner weather-proof wires handled by the Central Electric Company are noted for the firmness and water-proof qualities of the insulation. The manner in which the braid is woven on the copper gives it particularly firm and lasting qualities. Nothing but the best grades of cotton and compound are used in the process of insulating, and these wires are particularly adapted for use among trees, where the circuits are subjected to severe abrasion. M. J. B.

Chicago, February 6.

OUR SAN FRANCISCO LETTER.

Work is rapidly progressing on the Oakland, Haywards and San Leandro electric road. It is contemplated that it will be in running order by Spring.

The Trustees of Nevada City, Cal., have under advisement the applications of several electric light companies for a franchise for an electric light plant. At present the city is poorly illuminated.

The Board of Trustees of the city of Vallejo are advertising for proposals for an electric light plant for municipal lighting. The successful bidder will be awarded a five years' contract for street arc lights, and a 10 years' charter privilege to do private and commercial lighting.

The Telephone Building, the handsome six story brick structure now in the course of construction on Bush street, San Francisco, by the Pacific Bell Telephone Company, is fast nearing completion. When ready for occupancy, it is claimed, it will be the best equipped and most commodious telephone exchange on the Pacific Coast.

Oakland is to have still another electric road. The Pacific Improvement Company state that the contracts for constructing same have been signed, and work is to commence at once. The cars are to be built by Carter Brothers, of Newark, Cal., and equipped by the Thomson-Houston Company. The road will extend from First and Broadway on the cable car track until Telegraph avenue is reached, and then directly to the State University at Berkeley. J. R. K.

San Francisco, January 29.

OUR SEATTLE LETTER.

Employes of the Tacoma Railway and Motor Company have organized an "electrical society," and will establish a reading room and library.

Estimates are being prepared on the cost of an electric railroad drawbridge to operate the Northern Pacific drawbridge at the head of the bay at Tacoma.

The Lowell, Everett and Mukilteo Electric Railroad has been organized. Norton Walling and R. J. Mooney are among the directors of the company.

The Linemen of Seattle had a fine electrical display at their annual ball on Christmas eve. The hall was brilliantly illuminated with arc and incandescent lights. Telephones were arranged near the music stand so that people from any part of this city or Tacoma could hear the band play. An electric clock and an electric weighing machine were also added to the furniture of the dressing rooms.

A Home Messenger Telegraph service has been organized here in opposition to the American District Telegraph Company. As a result, the latter corporation has cut its rates about 30 per cent. The rates are now: Twelve blocks or less, 10 cents; 16 blocks, 19 cents; 20 blocks, 20 cents; over 20 blocks, 20 cents, with an additional 10 cents for car fare. The former rates were: Ten blocks or less, 15 cents; 10 to 16 blocks, 20 cents; 16 to 20 blocks, 25 cents. The rate by the Home has been lowered from 30 to 20 cents.

Both the Pacific Postal and the Western Union Companies are said to be trying to get control of the telegraph line on the Seattle and Montana to South Westminster. The Western Union especially would like to secure control, having no line north of Seattle, and being almost at the mercy of the Postal for the transmission of messages North. At present, however, it looks as if James J. Hill, president of the Seattle and Montana Railroad would operate the line. But the Western Union Company will soon have at least one line North, for it has let the contract for an extension along the Seattle, Lake Shore and Eastern Railroad, to Sedro.

There is considerable rivalry between the Edison and the Thomson-Houston agents in this city. W. J. Grambs, the local agent of the Edison Company, has issued the following challenge: "The Edison General Electric Company hereby challenges the Thomson-Houston Company to a competitive test of the efficiency and relative merits of their respective systems of single reduction motors, under similar conditions of load, speed and grade, etc., on the James Street Railway, each party to deposit $500 with the *Post-Intelligencer* Company, the loser in this competition to authorize the *Post-Intelligencer* Company to deliver the amount of his deposit to the Women's Aid Society or some other charitable institution of this city.

Seattle, Wash., January 30. H. L.

Seeking Electrical Data.

On January 20, the Philadelphia Traction Company mailed a series of questions to all the leading electric companies in the United States, of which a number are located in Philadelphia. These questions do not go into the cost of the electric car system at all, but simply are directed at the capacity of each company's plant and the style of construction which it favors. The companies are asked to specify the various engines that they build, the scale of the engines' sizes, and the power of each size. They are further to state the length of time required to build each engine.

The questions also refer to the motors used, their size and capacity, the time required for their construction, etc. The style of wire favored by each company is also asked. The series of questions covers about ten typewritten pages, and, without touching upon cost in any way, covers the entire work of construction of an electric railway.

Subway Rates and the East River Company, of New York.

The East River Electric Light Company, of New York city, has submitted to the Mayor copies of correspondence between the company and the subway company, showing that the cost of subway rentals to the East River Company was 3⅜ cents per light per night on Fifth avenue. The company, some time ago, submitted to the Gas Commission a bid of 60 cents a night per light for lighting the avenue.

The Commission wanted the company to reduce their bid to 40 cents per lamp and the correspondence is submitted to show that the company would lose money at that price. The bid of the company will be considered at the next meeting of the Gas Commission.

PERSONAL.

Mr. W. A. Stadelman, of Philadelphia, was a recent New York visitor.

Mr. John Beckley, the electric railway magnate of Rochester, N. Y., was among the New York visitors last week.

Geo. W. LaRue, the genial manager of the Crocker-Wheeler Electric Company, was in Jacksonville, Fla., the other day.

Mr. W. J. Cooke, vice-president of the McGuire Manufacturing Company, Chicago, spent a few days in New York last week.

Mr. Wm. H. McKinlock, president of the Central Electric Company, Chicago, spent the greater part of last week in New York.

Mr. J. R. McKee, general manager of the Thomson-Van Depoele Electric Mining Company, Boston, spent a day or two in New York recently.

Mr. Chas. A. Tucker has disposed of his interest in the Tucker Electrical Construction Company, of New York, and has resigned as president of that well-known company.

Prof. Richard H. Bull died in New York city on the 1st inst., at the ripe age of 75 years. He was associated with Professor Morse in the experiments which led to the invention of the telegraph.

Mr. Hollon C. Spaulding has resigned from the Thomson-Van Depoele Electric Mining Company, Boston, and has gone into the manufacture of wood-working machinery at Dover, N. H. While his friends in the electrical field will regret to lose Mr. Spaulding from the fold, they will, nevertheless, wish him success in his new venture.

Mr. Alfred E. Kornfeld, who has been connected with electrical journalism for the past six years, will hereafter be connected with the Himmer & Anderson Dry Battery Company, in the capacity of business manager. Mr. Kornfeld has been favorably known in the electrical field, and no doubt, with his business ability and several years of experience, the combination will prove a success.

National Electric Light Association.

NEW YORK, February 4, 1892.

TO THE EDITOR OF ELECTRICAL REVIEW:

Arrangements have been perfected for a special vestibule train, composed of parlor, dining and buffet cars, which will leave the Grand Central station, *via* N. Y. C. and H. R. R. R., at 11 A. M., on Monday, February 22 (Washington's Birthday), and will connect with the Boston party at Albany. Seat checks for this train can be procured from C. O. Baker, Jr., master of transportation, room 505, 136 Liberty street, at the rate of $2 each. Railroad tickets can be procured at the various ticket offices. It will, however, be necessary for the purchaser to request the ticket agent to furnish him with a certificate, which will entitle him to rebate fare on his return passage. These certificates are made absolutely non-transferable.

The following gentlemen have charge of transportation matters for their respective localities:

H. A. Cleverly, 1018 Chestnut street, Philadelphia; Fred. W. Royce, 1408 Pennsylvania avenue, Washington; A. C. Shaw, 620 Atlantic avenue, Boston, John L. Martin, 148 Michigan avenue, Chicago; Morris W. Mead, Pittsburgh, Pa.; S. D. Nesmith, Thomson-Houston Electric Company, Cleveland, Ohio; C. F. Hesser, Cincinnati Electric Light Company, Cincinnati; H. D. Stanley, Bridgeport, Conn.; Prof. Henry T. Bovey, McGill University, Montreal, Canada; M. J. Hart, New Orleans, La.; James I. Ayer, 322 Pine street, St. Louis, Mo.; Frederic Nicholls, Toronto, Canada; John I. Sabin, San Francisco, Cal.; E. W. Rollins, Denver Consolidated Electric Company, Denver, Colo.

Yours very truly,
C. O. BAKER, JR.,
Master of Transportation.

Secretary Porter sends us the following list of the papers to be read at the Buffalo Convention of the National Electric Light Association:

"How to Fire a Steam Boiler," by Richard Harmond; "The Allied Powers," by Daniel Ashworth; "Switchboards: Their Safety and Operation," by M. C. Sullivan; "Aerial Wires," by E. F. Peck; "The Alternating Motor," by Wm. Stanley, Jr.; (subject to be announced) by L. B. Stilwell; "From the Tannery to the Dynamo," by Chas. A. Schieren; "Underground Wiring," by E. A. Leslie; "Underground Systems," by J. B. Craven; "Municipal Franchises for Quasi-Public Works," by Allen R. Foote; "Electric Lighting from a Financial Standpoint," by Erastus Wiman.

Mr. Carl Hering, of Philadelphia, will give an evening lecture on "The Transmission of High Potentials," illustrated by stereopticon views, based on the work done at Lauffen-Frankfort. Prof. Elihu Thomson, William Stanley, Jr., H. Ward Leonard, and others, will take part in the discussion following the lecture.

Electric Heating.

TO THE EDITOR OF ELECTRICAL REVIEW:

I wish to call attention to some misleading statements concerning the cost of electric heating, by Mr. W. R. B. Willcox, in your issue of January 30. Speaking of the Burton heater, he tells us that in one case the cost of *coal* necessary to supply current to a set of four heaters, requiring two horse-power, is 12¾ cents per car day of 18 hours, as against *cost of stove heat*, 25 cents for the same time, and in a second case the cost of *coal* to supply current to a similar set of heaters is 15 cents per car day of 10 hours, as against *cost of stove heat in this case* 35 *cents* for the same time. I would respectfully call the attention of your readers to the fact that he has compared "cost of stove heat" with the cost only of the *coal* to make the "electric heat" (if I may use the term), and he further allows us to infer that the heats made in the two cases are the same.

Evidently the cost of the *coal* is not all that must be considered when we estimate the relative values of various systems of heating. Why does he not reckon in the interest, deterioration, cost of repairs and management of the electric plant and lines, or that part of it which is used to make the electricity with which he does his heating. Did he do this I do not think it would appear that it is from two to three times as cheap to use an electric heater as a coal stove.

And, further, if writers on electric heaters would be more careful to keep in mind the fact that our best steam engines of to-day only utilize from 10 to 12 per cent. of the energy of the coal as burned under our best boilers, and that the "efficiency" of many furnaces is from 75 to 85 per cent., and sometimes higher, fewer such ridiculous comparisons would be made between electric heaters and coal stoves.

Again, the gentleman hopes after "earnest work" to "increase the *efficiency of the heaters themselves* in order that the greatest possible amount of heat may be obtained from a given amount of current." Wonderful! Wonderful! Will the gentleman explain how an "electric *heater*" can have an efficiency of *less* than 100 per cent., and how he expects to increase it?

Yours very truly, R. B. OWENS.
Lincoln, Neb., February 1, 1892.

The ocean cables of the world now stretch over 120,250 miles. There are 1,000 cables in all, nearly all of English manufacture. Private corporations own most of these cables.

Telephonic News

*** The New England Telephone and Telegraph Company, has declared a dividend of $1.25 per share payable February 15.

*** The Southern New England Telephone Company report yearly earnings for 1891 equal to $120,000, on a capital stock of $1,500,000.

*** The Sunset Telephone Company is running another wire from Stockton to San Francisco, Cal., making two distinct lines for the entire distance.

*** The telephone line between Santa Barbara and Soleta is being staked out, and the connection throughout Southern California will soon be completed.

*** Mr. Geo. D. Sherman, manager of the telephone exchange at Faribault, Minn., has been transferred to the exchange at Stillwater, Minn., an exchange having about 200 subscribers.

*** According to the *Boston News Bureau*, Justice Colt, in the United States Circuit Court, has granted the application of the defendants to October 1 to put in testimony in the case of the Government *vs.* the Bell Telephone Company.

*** The Piscataquis Central Telephone Company, of Maine, will, in the Spring, build a telephone line from Dexter to Exeter, to Garland, Charleston, Levant, East Corinth, Kendaskeag and Bangor. This distance will be about 50 miles.

*** It is rumored that a company with a capital of $100,000 is being formed, with Messrs. Oppenheim & Kahnau, two local capitalists of St. Paul, Minn., as the principal stockholders, to take the place of the St. Paul District Telegraph Company. The new company will make a specialty of delivering telephonic messages.

*** The executive committee of the Erie Telegraph and Telephone Company, have recommended to the directors that a quarterly dividend of one per cent. be declared, payable February 15, to stockholders of record February 6. The Cleveland Telephone Company, the Northwestern Telephone Exchange Company and the Southwestern Telegraph and Telephone Company, report for the three months ending December 31, 1891, a gross income of $222,485.95; gross expenses, including dividends paid, $213,860.80; surplus, $8,625.15; proportion of dividends received by the Erie Telegraph and Telephone Company, $54,995; dividend No. 33, $48,000; surplus, $6,995; total surplus for the three months, $15,620.15. Subscribers—Number connected September 30, 1891, 13,733; added during the quarter, 278; total number connected December 31, 1891, 14,011.

*** The Missouri and Kansas Telephone Company held its annual meeting recently and elected the following directors: J. R. Mulvane, T. B. Sweet and Edward Wilder, of Topeka; John E. Hudson and George Albree, of Boston; C. E. Yost, of Omaha; S. A. Walker, of St. Joseph; J. S. Chick and N. R. Ferguson of Kansas City. The following officers were elected: J. R. Mulvane, president; W. W. Smith, secretary, and N. R. Ferguson, treasurer. Executive committee, J. R. Mulvane, J. S. Chick and N. R. Ferguson. At the meeting it was finally decided to remove the Kansas City Exchange from the Wales building to the Security building, at Sixth and Wyandotte streets, and the executive committee was authorized to arrange for the addition of another story to the building for the accommodation of the exchange. The question of underground conduits and other improvements was disposed of by reference to the executive committee with authority to take any needed action.

Fort Wayne Electric Company's Plant.

One of the largest and probably the best equipped and conveniently arranged electric plants in this country to-day is that of the Fort Wayne Electric Company, of Fort Wayne, Ind.

The plant is conveniently situated in the heart of this flourishing little town of 40,000 inhabitants, and is the most prominent industry of the place, covering as it does about four and one-half acres of ground, and giving employment on an average to nearly 500 men.

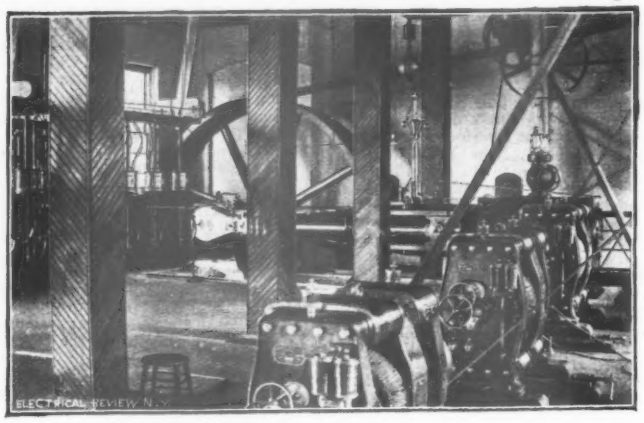


FIG. 1.—ARC LAMP TESTING ROOM, FORT WAYNE ELECTRIC COMPANY.

There are 10 substantial brick buildings on the property occupied by different branches of the industry, each one lighted, heated and equipped in the most thorough manner. The lines of the Pennsylvania and Wabash Railroads are in the immediate vicinity, and side tracks from both roads run directly to the doors of the shipping department.

The first of the series of buildings as the property is approached from the street is devoted entirely to the offices of the concern. This is a well-built brick structure, 65x60 feet and two stories high.

The entire first floor is occupied by the general offices, and on the second floor are located the private offices of the heads of the various departments. The building is finished throughout with hard wood, and, being detached on all sides, is abundantly supplied with light, as indeed are all the buildings on the property.

Directly in the rear of the offices, and separated from them by a 20-foot driveway, is the main machine shop.

This is a three-story brick building, 50x200 feet, all three floors of which are completely filled with the finest machinery and most modern appliances known to the trade.

The power for driving the main shafting is derived from a 250 horse-power Hamilton-Corliss engine, situated in a large brick annex, separated from the main floor of the machine shop by a solid partition wall. The driving wheel of the engine is 16 feet in diameter, and has a belt surface of 30 inches. It is run at 70 revolutions to the minute, at a pressure of 85 pounds.

This building also contains an Armington & Sims high speed engine for experimental purposes and a 1,500 light Slattery machine for general testing. The main line and counter shafting is fitted with the Falls Rivet and Machine Company's clutch pulleys, by means of which any machine may be cut out or run independently of the others.

Adjoining the main engine room is another building of similar size, containing the boilers. There are four of these, three of 100 horse-power each and one of 150 horse-power. These are built by the Bass Foundry and Machine Company, of Fort Wayne. Natural gas is used under them exclusively and gives perfect satisfaction. Attached to the boiler room, and separated from it by heavy iron doors, is a room containing an apparatus by which the entire plant is heated by means of the exhaust steam from the engines. This machine is manufactured by the Buffalo Forge Company, and consists of a large air chamber, in which is coiled row after row of pipe. This pipe is constantly kept filled and heated by the exhaust steam. A rapidly revolving fan forces fresh air from outside between these coils of pipe and from them through the various departments of the buildings, which are kept at an even and agreeable temperature.

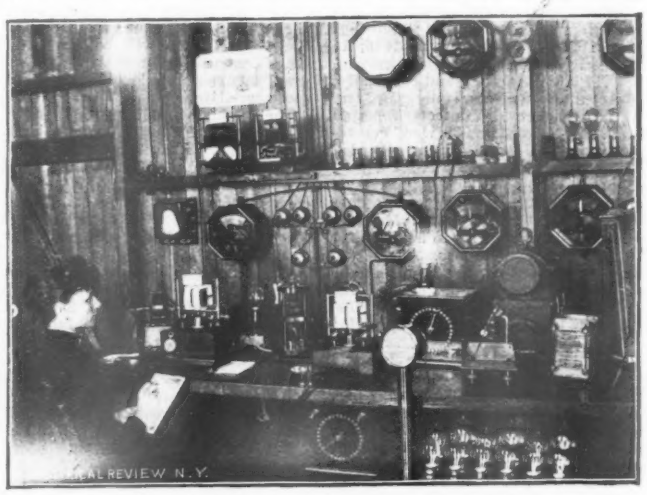


FIG. 2 —METER TESTING ROOM, FORT WAYNE ELECTRIC COMPANY.

FIG. 3.—METER DEPARTMENT, FORT WAYNE ELECTRIC COMPANY.

The arc light testing room is, probably, the finest in the world. It occupies the entire first floor of a separate building, 70x40 feet, and two stories in height.

On one side of this room are four Wood dynamos, of 2,000 candle-power each, one being an 80 light machine, one 60, one 40, and one 25 lights. The other side is entirely filled with racks on which 157 lights can be tested at one time.

The driving power is furnished by a Bass Corliss engine of 200 horse-power. The upper floor of this building is used as a carpenter shop.

The brass foundry occupies a separate building, 80x40 feet, and here all the castings of this description used by the company are made.

A two story brick wing, 40x60 feet, contains on the first floor an experimenting room, a dipping room and japan room and a nickel-plating department. The second story is occupied by the pattern room, which is connected by a covered bridge with the carpenter shop.

On the ground floor of another wing of the main building, 50x140 feet, the heavy castings and large pieces of machinery are finished up. The winding department for armatures and converters occupies the second floor, and the third floor is devoted to the manufacture of arc lamps, 26,000 of which have been put on the market within the past two years.

The third floor of the main building is occupied chiefly by the meter and line fixture departments, and the testing room for meters. These are of the Slattery induction system, and tested to register accurately from one light to their full capacity.

Still another large building is used as a storehouse for finished parts and machines. The shipping department is also located here, and machines are loaded from a platform in front of this building directly into the cars.

Notable among the specialties manufactured by the Fort Wayne Electric Company are the Slattery alternating current machines for incandescent lighting and the Wood arc light machines. They are now working on an order of the Municipal Electric Light Company, of St. Louis, for ten of the incandescent machines, of 3,500 lights each, and the same company already has 6,000 of the Wood arc lights in use. Some idea of the size of these large Slattery incandescent machines may be had from the fact that the weight of each machine is about 24,000 pounds.

The local sub-company holds the contract for lighting the town, and their station for this purpose is located on the bank of the river, from which sufficient power is derived to run the plant most of the time without the aid of steam.

The main shaft is fitted with clutch pulleys made by the Hill Clutch Works, of Cleveland, O., and by means of these steam and water power can be used at the same time, or either one separately, if desired.

The outfit consists of two 1,200 light incandescent machines, nine old style Jenney dynamos of 30 lights each, three 60 and two

80 light Wood arc machines. These are driven by a 500 horse power Bass-Corliss engine, the wheel, which is 24 feet in diameter with a belt surface of 54 inches, making 65 revolutions per minute. Attached to the main shaft is a Pritchard electric governor which regulates the water supply from the wheel house and insures an even amount of power.

From here also connection is made with the power house of the School for Feeble Minded Youth, a large and extremely prosperous institution, a mile distant on the opposite side of the river, where a fine 600 light plant of the Fort Wayne system is in use, so that in the event of an accident to their engine the lights there can still be kept going.

From this brief description it will readily be seen that the Fort Wayne Company is a power in the community, and by reason of their strict integrity and progressive business methods, looked up to and respected on all sides. The officers are: President, H. G. Olds; vice-president, P. A. Randall; treasurer and general manager, R. T. McDonald; secretary, Brainard Rorison.

The International League of Press Clubs.

The annual convention of the International League of Press Clubs was held in San Francisco January 14, 1892. There were in attendance representatives from some 25 clubs, which includes a total club membership of 3,000. Sessions were held January 14, 15 and 19, at the very comfortable rooms of the San Francisco Press Club. Many valuable features looking towards extending the influence and increasing the strength of the League were, after careful consideration, adopted, and a few important changes in the by-laws were made. Among these were the establishing of a national home for newspaper workers who had, through age or infirmities, become incapable of providing for themselves. This idea was ably presented by Mr. William Berri, chairman of the New York delegation, and was, upon motion, referred to the governing board of the League, as was also a proposition to raise a benefit fund for newspaper workers in temporary need. The next meeting will be held in St. Paul, Minn.

An open literary session was held at the Powell Street Opera House on the evening of January 15. Interesting and instructive addresses were delivered by Miss Kate Field, Mrs. Frank Leslie, Mr. Foster Coates, Mr. Lynn R. Meekins, Mr. C. M. Shortridge and others, Mr. William Berri presiding at the meeting. Letters of regret, all of which strongly endorsed the objects of the League, were read at this meeting by the secretary. Among these were communications from Gen. Felix Agnus, Col. Elliott F. Shephard, George William Curtis, Col. John A. Cockerill, Max O'Rell, James Whitcomb Riley, Joseph Howard, Jr., Max Nordeau, of Paris, Chester S. Lord, Murat Halstead, Henry Watterson, William Penn Nixon and several others. These letters and addresses will appear with the abstract of the proceedings, which will be issued by the secretary of the League. Officers for 1893 were elected, as follows:

President, M. H. DeYoung, San Francisco *Chronicle*.

Vice-Presidents, John A. Cockerill, New York *Commercial Advertiser;* Gen. Charles H. Taylor, Boston *Globe;* George W. Childs, Philadelphia *Ledger;* Gen. Felix Agnus, Baltimore *American;* P. B. Deuster, Milwaukee *Seebote;* Mrs. Sallie Joy White, president New England Women's Press Association.

Secretary and treasurer, Charles W. Price, ELECTRICAL REVIEW, New York.

Executive Committee—T. J. Keenan, Jr., Pittsburgh *Press;* Stephen O'Meara, Boston *Journal;* Dr. John Frederick, New York *Americanische Schweizer Zeitung;* P. C. Boyle, Toledo *Commercial;* H. P. Hall, St. Paul *News;* H. D. Vought, Buffalo *Courier;* William Berri, Brooklyn *Standard-Union;* John B. Dampman, Reading, Pa., *Herald;* S. G. Lapham, Syracuse, N. Y., *Courier*.

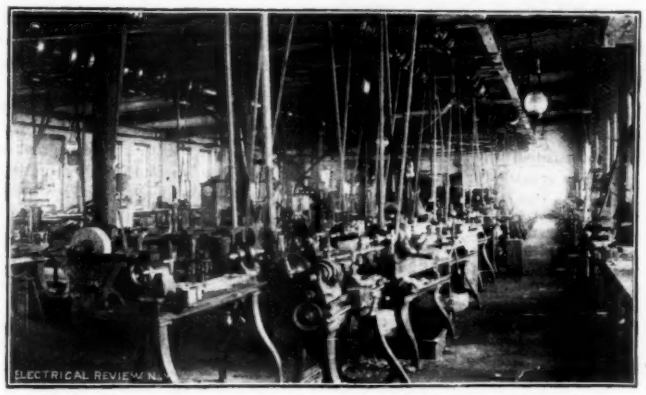


FIG. 4.—ARC LAMP DEPARTMENT, FORT WAYNE ELECTRIC COMPANY.

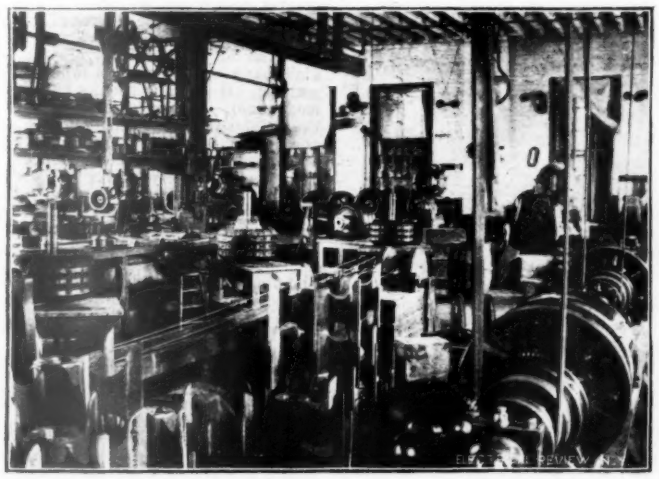


FIG. 5.—ASSEMBLING ARC ARMATURES, FORT WAYNE ELECTRIC COMPANY.

The trip across the continent in the magnificent Wagner vestibuled train was so successfully made and so full of interest, that the League decided to appoint a historian, and Major T. P. McElrath, of the *American Analyst*, of New York, was selected for this work, and he, in conjunction with the president and secretary of the League, will publish, in book form, a full report of the leading incidents connected with the trip. Nearly 9,000 miles were traveled by the delegates and their wives, the special Wagner train leaving New York the morning of January 6, and arriving in this city on its return at 10 o'clock P. M., January 31. It is impossible in this brief space to even allude to the many interesting features of this truly wonderful trip. The officials of the Wagner Palace Car Company, and the officials of the New York Central and Hudson River Railroad Company, spared no pains and no expense in looking after the comfort and safety of the travelers, and this was appreciated by the League which, at the first session, unanimously directed the president and secretary to telegraph from San Francisco the hearty thanks of the International League of Press Clubs. Mr. J. C. Yager, division superintendent of the Wagner Palace Car Company, accompanied the party the entire distance, and Mr. M. C. Roach, general Eastern passenger agent of the New York Central, accompanied the party as far as Chicago, and Mr. W. B. Jerome, general Western passenger agent of the same company, accompanied the party from Chicago to San Francisco and back to Detroit, where Mr. Roach and Mr. W. H. Underwood, of the Michigan Central, met them. Receptions, banquets and drives were given at all the points along the line, and upon the arrival in California the hospitality of that beautiful State was made evident at every point. *En route* West the party stopped at Chicago, Omaha, Denver, Salt Lake City, and Auburn, California, and while in the State excursions were made to Sutro Heights, Monterey, San José, Mount Hamilton (to see the Lick Observatory), Sacramento, Fresno, Los Angeles, Riverside, San Bernardino, Redlands, San Diego, Coronado Beach Hotel, and at all the cities banquets and drives were given. At San Diego the entire party visited the cruiser "San Francisco," where a reception was held on board by Admiral Brown and staff. The wineries and orange groves, etc., of Southern California were visited and greatly delighted the Eastern delegates. The return trip was made over the Atchison, Topeka and Sante Fé railroad system to Kansas City, which road had the honor of hauling the train the greatest number of miles. The railroad officials of all the roads traversed were particularly courteous and welcomed the travelers most cordially. Stops were made on the return at The Needles, at the San Juan Capistrano Mission, at Sante Fé and Las Vegas, New Mexico, and at St. Louis a reception and banquet was enjoyed, also a delightful banquet at Toledo, Ohio, and at Detroit, Mich. At the last named city ex-Governor Alger tendered a reception to the entire party at his beautiful residence, and the next morning a sleigh ride and Winter view was enjoyed at Niagara Falls, the party reaching New York that evening, January 31. Not an accident of any kind occurred in the entire trip, undoubtedly the most remarkable railway tour ever made.

FIG. 6.—ARMATURE WINDING ROOM, FORT WAYNE ELECTRIC COMPANY.

TELEGRAPHIC

.... The law firm of Dillon & Swayne has dissolved. It is stated that Judge Dillon will remain as counsel for the Western Union Telegraph Company.

.... Justice Ingraham, of the Supreme Court, has directed a verdict of $88,875, in favor of Edward S. Stokes, in his recent suit against John W. Mackay and Hector De Castro.

.... The Spalding Telegraph Company filed its certificate of incorporation at Albany, N. Y., last week. Its line is to begin at Ogdensburg, St. Lawrence County, and stretch from there to New York city; thence to Trenton, N. J., and across Pennsylvania to Wilmington, Del. The company starts with a capital of $1,000 only. The stockholders are Henry C. Spalding, John G. King and Charles Babbidge, of Boston; Eben B. Crane, Jacob Abels and Dana A. Rose, of New York city, and Will P. Charles, of Brooklyn.

New York Electrical Society.

The next meeting of the New York Electrical Society will be held, Wednesday evening, February 17, at the new operating room of the Western Union Telegraph Company, 195 Broadway.

American Institute of Electrical Engineers.

The sixty-fourth meeting will be held at the headquarters of the Institute, 12 West Thirty-first street, near Fifth avenue, on Tuesday evening, February 16, at 8 o'clock. A paper will be read by Lieut. F. Jarvis Patten, on "A Proposed New System of Alternating Direct Current Transformation." Members who are especially interested in this subject may secure advance copies upon application to the secretary, which will be forwarded at the earliest possible moment. Distant members are invited to contribute their remarks in writing, in case they are unable to be present.

Mr. Thurber Sues the Jarvis-Conklin Mortgage Company.

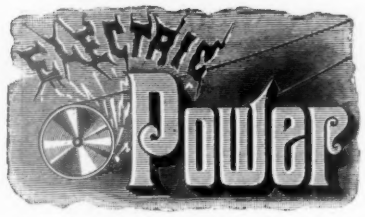
The Jarvis-Conklin Mortgage Company, with offices in New York, Chicago, Kansas City and San Francisco, was sued for $100,000 in the Superior Court at Chicago last week by Horace K. Thurber, of the Thurber & Whyland Company, of New York city.

The litigation grows out of an investment in an electric railway company at Ogden City, Utah, out of which, Mr. Thurber says, he did not get his just due. The road was built a few years ago and heavily bonded, Mr. Thurber becoming a creditor to the extent of $84,000. The Jarvis-Conklin Company also held a trust deed, and one morning Mr. Thurber found that his fellow creditors had foreclosed, and that the property had been sold from under his claim. The present suit is brought to enforce the bondholders' claim against the company.

Chicago Electric Club.

The Chicago Electric Club held a very brilliant meeting at its Club rooms on the 3d inst., over 100 members being in attendance. The subject discussed was the paper read by Francis W. Parker, on "The Necessity and Present Opportunity for the Establishment of a Technological Institution, with Physical Laboratory and Museum of Mechanical Arts, in Chicago." President Sunny, of the Club, read a paper on "The Attitude of the Electrical Interests Toward the Proposed School." Ex-Mayor Roche, Dr. W. R. Harper, A. H. Revell and the Rev. Dr. Henson, spoke forcibly and brilliantly, and the project found many supporters.

After the exercises a collation was served in the Club dining room. A telegram was read from Lyman J. Gage, J. J. P. Odell and F. W. Peck, who are in New York, commending the enterprise and declaring that it would have ample financial support.



* * Montgomery, Ga., is again figuring on an electric street railway.

* * An electric railway from Philadelphia to Unionville seems to be an established fact.

* * A scheme for an electric road between Fresno and Hanford, Cal., is being pushed by local men.

* * Manchester, N. H., is making a decided move to form a syndicate to build electric roads in that city.

* * The subject of an electric railway at Washburn, Miss., around the head of the bay, has been seriously discussed.

* * A company has been formed at Connellsville, Pa., to build an electric railway at that place. J. W. Reed is president.

* * Charles E. Benton was recently appointed receiver of the Belt Line Electric Street Railway Company, of Utica, N. Y.

* * The Westinghouse Electric and Manufacturing Company, it is stated, is preparing to equip a steam railroad near Sioux City, Ia., with electricity for motive power.

* * A representative of the syndicate that purchased all the street car lines of Detroit was recently in Youngstown, Pa., looking over the territory for the purpose of putting in a competing street car line.

* * It is announced that the Baltimore Traction Company has secured control of the North Baltimore Passenger Railway lines. Electricity will probably be used for motive power in the near future.

* * In a recent bulletin, issued by the railway department of the Thomson-Houston Electric Company, it is stated that there were 204 Thomson-Houston electric street railways, using 3,212 cars, in operation or under contract on December 15, 1891.

* * The Consolidated Street Railway Company, of Grand Rapids, Mich., has just placed an order with the Short Electric Railway Company for twenty 40 horse-power gearless equipments to be used on their lines, which are being changed over to electricity. This contract was made after very careful personal investigation of all the leading systems by the general manager of the company, Mr. J. R. Chapman.

* * The Thomson Houston Electric Company has established a new electric railway supply department, which will handle all kinds of railway supplies, including all necessary parts for overhead construction, motor and generator repair and station equipments. The supplying of motor and generator parts is confined to Thomson-Houston apparatus. Other railway supplies consist of the best on the market, selected from an intimate knowledge of the requirements, based on the experience of this company in its extensive railway work, extending over a period of several years.

* * For three weeks a bitter strike has been in progress on the Pittsburgh, Allegheny and Manchester electric street car line at Pittsburgh, Pa. On the 3d inst., a dynamite cartridge was placed on the track and exploded as one of the cars passed over it. The car contained 13 of the new employés and was quite badly used up; one wheel was blown off, the motor injured, the front part of the car thrown from the track, its windows shattered and the workmen thrown to the bottom of the car. Fortunately no one was seriously injured. The company offered a reward of $1,000 for the arrest and conviction of whoever caused the explosion. One man has already been arrested on suspicion.

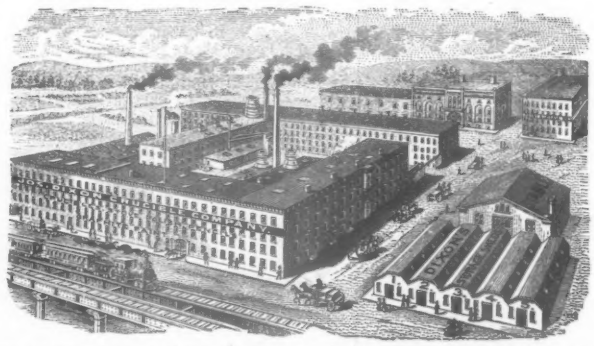
Brown & Sharpe's Plain Milling Machine.

The Brown & Sharpe Manufacturing Company, of Providence, R. I., have recently brought out a new plain milling machine which they call their "No. 4."

The overhanging arm supports the outer end of the cutter arbor, either on a center or in a bushing, and may be rigidly connected with the knee by an arm brace. The spindle boxes are bronze. The saddle rests directly upon the knee, and the platen is heavy and moves only at right angles with the spindle. It has three T slots and is surrounded by a channel for oil. The spiral head and foot stock are not furnished with the machine and no provision is made for cutting spirals. In other respects the machine is similar to the No. 1 Universal milling machine with overhanging arm.

The platen is 32 inches long and 7 inches wide. It has an automatic feed of 20 inches, and may be stopped automatically at any point while moving in either direction. It can be lowered 18½ inches from the center of the spindle, and the saddle has a movement of 6¾ inches in line with the spindle. The greatest distance from the center of the platen to the face of the stand or knee slide is 11 inches. There are six changes of feed varying from .008 to .100 inches per revolution of the spindle.

The vise swivels and has a graduated base. The jaws are 5⅛ inches wide, 1⅛ inches deep and will open 2¾ inches. The overhead works have two friction pulleys, 14 inches diameter, for 3½ inch belt and hangers with adjustable and self oiling boxes. The counter-shaft should run about 110 revolutions per minute. The floor space occupied is 64½x44 inches. The weight, boxed, ready for shipment, is 1,850 pounds.



THE JOSEPH DIXON CRUCIBLE COMPANY'S FACTORIES, JERSEY CITY, N. J.

The Graphite Industry.

The graphite industry is fittingly represented by the company whose founder first gave it birth.

The Joseph Dixon Crucible Company, Jersey City, N. J., was founded by Joseph Dixon in 1827, who, at that time, began the manufacture of black lead crucibles and completely revolutionized the crucible business. All crucibles used at the present day for melting brass, steel, copper, gold, silver, nickel, etc., are made of black lead (the common name for graphite), and by the Dixon process.

The Dixon Company have not only been progressive, but they have been aggressive, and have pushed their goods into all parts of the civilized world. During the past year they made extensive changes in their factories, and we take pleasure in showing by the illustration above the main works and offices located in Jersey City. Their graphite mines are at Ticonderoga, N. Y., and their cedar mills are at Crystal river, Fla.

The nature of graphite, sometimes called plumbago or black lead, is not generally understood, and therefore, its great value in the mechanical arts has not been fully appreciated. Graphite is one of the forms of carbon. It is not affected by heat, cold, acids, alkalies, or any known chemical solvent. It is also the best solid lubricant known to science, a remarkable conductor of heat and electricity. The peculiar qualities of graphite have given it a wide range of usefulness. It is used in the manufacture of lubricants for all purposes, crucibles, stove polish, lead pencils, foundry facings, electrotyping graphite, graphite paint, etc.

The Dixon Company are miners as well as importers of graphite in all its forms, and use no graphite that they do not mine or prepare. Their mines are located in Ticonderoga, N. Y., and they have every facility in the way of chemists and expensive machinery, etc., necessary for completely freeing the graphite from the silica, sulphur and other impurities which it contains when it comes from the mines.

PRACTICAL NOTES ON THE REFLECTING GALVANOMETER AND ITS ACCESSORIES.

BY J. D. BISHOP.

XVII.

GENERAL HINTS.

Leads—If your battery room is some distance from your galvanometer room or the latter from the cables or other wires you are testing be careful to have good leads. No. 16 wire insulated to one-fourth of an inch with rubber compound and braided will do.

Faulty leads will give you a great deal of trouble. Run them through wooden cleats and carefully avoid staples everywhere. Do not try to economize wire by using bare copper wire strung on those wretched little porcelain grooved rings, which are misnamed insulators. Do not save wire by having ground connection made with gas or water pipes. From one end of your galvanometer circuit to the other use the best of wire for leads.

If they are of any length, carefully measure their resistance and their capacity and note it for future reference.

If your leads come from a wall or ceiling to any of your connections close to either, make a spiral of a foot or two of wire so that the short space across may be bridged by a good length of dry insulator. This is especially necessary when walls or ceiling are damp or exposed to steam.

Connections—Connect all your keys and switches with No. 16 thickly insulated wires and pass them down through the table and up again so that they may be out of the way.

From your keys to the galvanometer they may be run under the table which carries the lamp, scale and magnets, and be brought up vertically through a couple of cleats fastened to the end of the table, terminating with bared ends on a level with the two holes in the shield. Two short pieces of leading wire should be brought from the galvanometer terminals through the rubber sleeves in the holes in the shield, and their bared ends terminate a few inches from the leads from the keys and the two be connected by a fine spiral of No. 30 or 36 silk covered wire, long enough to droop well down between the two ends of each wire. This is necessary in order to avoid vibrations of the table from being communicated to the galvanometer.

Precautions—Absolute cleanlinss and dryness are necessary to secure good work. When dust accumulates, wipe it off steadily and carefully with a chamois leather; beating it off with a silk handkerchief or a feather broom will only excite the hard rubber surface and again attract more dust.

If your galvanometer room is in a damp situation, or the weather is damp and muggy, test for leakage every morning, which is simply done by putting on full battery with open line terminals before taking your constant deflection, from which the leakage deflection, if any, must be deducted, and also, of course, from your test deflections. If, after all your wiping you cannot get rid of leakage, get four ordinary glass insulators and place under your stool or chair legs, and at least keep your fingers and the hard rubber finger pieces of your keys, dry. This will often get rid of an apparently inexplicable leakage.

XVIII.

MISHAPS.

Disappearance of spot—You will be a wonderful exception to the rule if you do not, however rarely, at times forget to put in your shunt peg or to open your resistance box or line terminals, and to send your whole battery current through the galvanometer. If you happen to be watching the scale at the time you will be surprised at the manner in which the spot flashes like a meteor across the scale, and still more surprised when you find you have to wait in vain for its reappearance.

If it is conspicious by its absence, do not touch the key again, but carefully look through all your pegs and switches in order to find out what you have or have not done.

Next have a careful look at the mirror through the hole in the rear of the shield, and you will find in all probability that it has got "stuck" against one of the sides of the mirror or vane cells. It will do this from mechanical cause or from the effect of electrical "charge" attraction.

Gently tap the sides of the shield with a pencil. If this has no effect proceed very carefully to increase the force of your blows. It may at times be necessary to administer a good slap to the shield or even a vigorous shaking, but generally slight tapping or jarring will free it. The effect of two violent a concussion is generally to free the mirror and send it flying around to stick in the opposite direction.

Magnetism of needles disturbed—If it returns to zero after this application of the bell current you will be lucky, but anyhow you will probaoly find your constant altered. If it does not return to zero, the needles have been magnetized to super-saturation by the current sent through the coils, and there is nothing for it but to allow it time to return to its normal strength.

Bring it to zero by means of the adjusting magnet and watch its gradual movement from it. You will be interested and probably learn something.

Or you may find after a blunder of this kind that your constant has fallen almost to nothing. If so, your needles have been demagnetized. In this case shift or remove the weights until the mirror hangs against one side of its cell, put in your 1,000 shunt and open your resistance coils, begin with your lowest battery power and gradually work up by increasing it, changing the shunt and plugging out resistances, all the while keeping the key down. Keep it down for a few moments and on releasing it, the galvanometer may again be leveled and you will find your needles have been again magnetized by the current you passed through the coils. In this case also you will have probably to wait for the "constant to settle down."

If, on repeated trial, your constant gradually gets higher, it is a proof that the needles are not fully magnetized but are becoming so by the effect of every current sent through the coils.

Needles reversed—Another effect of sending one of these heavy currents through the coils is to reverse the polarity of the needles, in which case when they are free, the mirror will be facing the rear instead of the front or lamp end. The chances are that they are not only reversed, but fully magnetized or even super-saturated.

The simplest method of correcting this is to cross your galvanometer leads, reverse your directing and controlling magnets and watch and wait until the spot keeps the position to which it is adjusted, for which center zero is best. The time required will vary with your galvanometer, or really, with the temper of your needles. It may be two hours or it may be two days. If left alone over night it will generally be found steady in the morning.

One moral of all this is that the short circuit key of your galvanometer should be stiffer than your battery key, not only in order to prevent accidental opening, but to secure a good contact between its points, the absence of which will be shown by a deflection when it is not open.

The same result will take place if the short circuit plug of your shunt box is not perfectly clean.

Now you see it and now you don't—When you sometimes get a deflection and everything seems to be in good order, and then suddenly every thing goes wrong without apparent reason, and you can get no deflection at all, either for test or constant, it is proof that you have an intermittent contact somewhere. It may be in a broken lead, if so, you will find it most probably close to one of the binding posts of battery or apparatus. Leads rarely or never part in any portion of their length. Feel all the ends of the wires and also closely examine the screws of the binding posts themselves. Put a fine wire detector in the circuit and plug out your galvanometer. If the trouble disappears then it must be in your galvanometer, and will probably be in the connections under the baseboard. These are very troublesome when they occur, and may be found to recur at regular hours of the day. Say from 3 to 5 every day this fault occurs, whilst all the rest of the day there is appar-

ently nothing wrong and every thing goes splendidly. You may find that at those hours the sun is shining on some loose connection, and by expanding the wire or hard rubber breaks contact. This is only one of a thousand causes, but it will serve to show how small a thing will create an excessive amount of worry and trouble. The worst of it is that they are often so very contradictory in their effects that it is almost impossible to avoid the conviction that some one has either been monkeying with the apparatus or that a practical joke is being played on you. There is nothing for it but close scrutiny and patience. You may find the cause at once or it may take days.

Short Lengths.—Unless you are quite *au fait*, do not attempt to measure insulation resistances of less than 100 feet lengths of cable; and when you are quite *au fait*, use Siemens' loss of charge method, the ordinary method of taking insulation tests being useless on joints and short lengths. If good, you will get no deflection with your ordinary working constant, and if bad, your deflections will be too unsteady to read. Sometimes, in testing bad pieces of cable, you will get a heavy deflection, which will gradually fall, with more or less irregularity, to nearly nothing. This is puzzling to a beginner. The cause is moisture in the circuit. Put on your highest battery power with the highest shunt, or even short circuit the galvanometer, so as to send a full current into the moisture and decompose it. Keep your battery key down. The deflection may, and in falling gradually to zero will, probably give several "kicks," and then begin to run along the scale until it goes off altogether, returning after a moment or two and behaving still more erratically. This is due to the decomposition of the moisture by the current, which forms a gas bubble, insulating temporarily, until it leaves the conductor and is replaced by more moisture.

Sometimes, if there is only one faulty piece, it may be cured by keeping on the current to its full strength, but this is of very rare occurrence.

The amount of moisture, which may vary from a mere film to actual drops of water, may be approximately estimated by the liveliness of the spot. There is a peculiarity about these deflections due to moisture which is difficult to describe, but their characteristics are easily and distinctly recognizable after two or three experiences with them. Sometimes cables into which moisture has entered will, after standing for some time, test up unexpectedly well, especially lead-covered cables. This will puzzle you, but if the cable is turned over, if on a reel, or coiled down again, if on the floor, the moisture or water will be disturbed and again wet the place which had become comparatively dry by standing, and the old fault will again become apparent. Before turning over a piece of suspected cable of this kind put in your highest shunt and your lowest battery peg, or you may "knock your spot out."

When you are sure that your constant is all right, and you can get only one, or less than one, division of deflection on the cable you are testing, you can only say that the insulation is too high to be measured with that constant, or that it is at least equal to that constant, and let it go at that.

If, on the contrary, you get one or more deflections flying all over the scale, you can only say, in round terms, that the cable is bad or that its insulation is immeasurably low.

When you have rea on to suspect a cable to be bad, be careful to begin with your highest shunt and lowest battery power, or you may upset your constant. In fact, it is a good rule to adopt this principle generally.

You will occasionally come across a length of cable which will test up extraordinarily high. This may be correct, but should always be open to suspicion until confirmed.

When this happens take your constant again and make sure that everything is all right in-doors. The high result may be due to a broken conductor. To try for this, plug in your highest shunt and lowest battery power and let an assistant touch the end of the conductor, the far end, of course. Or connect the end of the conductor with a ground or the lead by laying a piece of damp paper or thread across them so as to connect the two. If your conductor is intact you will get a greatly increased deflection, but if it is broken there will be no difference from the first one.

Test for the distance of the fault by discharge, from each end alternately, as a check.

If the cable is to undergo a prolonged series of tests extending over hours or days, it is absolutely necessary that the ends be carefully protected from moisture. They should whilst still dry and immediately after being stripped, be treated to four or five coats of good shellac varnish. If lead covered, the lead should be removed for 10 or 12 inches and every particle of the exposed insulation protected with the varnish. Whilst stripping off rubber or rubber compound from the conductor, men, unless watched, are apt to wet their knives with their lips, which should be prevented.

The ends should not even be handled after it has once been prepared or the moisture from the hands will cause the cable to give a lower test than it merits.

If available, dipping the end in boiling hot paraffine is a speedier method than varnishing, but is not so reliable.

Ordinary tests, however, take but a few minutes, and more than ordinary care to avoid handling the ends, is not requisite.

When cables contain many conductors, as with telephone cable, for instance, the easiest way to prepare the ends is as follows:

Strip off a foot or 18 inches of the lead at the testing end. Bind the conductors firmly about six inches from the end. Open out the conductors and burn off about three inches of the insulation, by setting fire to it, and wipe off the cinders thoroughly. Bunch all the conductors together firmly, except the wire you are going to test, and connect them to the lead pipe with a few turns of wire.

The far end of the cable should also be stripped of its lead for about 10 inches and the binding beneath it released. The conductors are then to be well opened out so that each one stands clear of its neighbor.

It is not unusual to test with the far end simply sawn off, but this is a careless method and likely to lead to loss of time.

If you have reason to believe that the results you get are not what they should be, cut off a foot from each end and take another set of tests. In all probability your insulation will be improved. The ends of the cables are sometimes not properly soldered up so that a little moisture gets in. It is not usual to test more than two or three wires in each layer so as to get an average result. Each wire should be returned to the bunch when tested so that your test may be what is technically termed "one against all the rest bunched to lead." Of course, your second galvanometer lead goes to the lead covering.

It will be a sufficiently good connection for all practical purposes, if the conductors are firmly twisted round the leading wires, as the resistance of such a connection is so small in comparison with that of the insulation that it may be neglected.

This kind of connection, however, would be useless if you have to take conductivity tests, in which case it must be clean, bright and better if soldered, but in practice you will not be often called on for these, and when they are required it is generally whilst the cable is on the reel. The inner end of the cable is brought outside through a hole in the reel, so that both ends of the cable are accessible for testing.

Cables which are lead covered are tested without being submerged in water, if the lead covering is continuous; but if covered with short jointed lengths submergence is absolutely requisite if a severe test is to be taken. Joints are nearly always the weak spots in any cable.

Cables which are armored with iron wires only will have to be submerged in water, for it is evident that they afford nothing but mechanical protection. They should be kept under water for at least 24 hours, and if they are not placed in an iron tank the armoring may be used as a return. The temperature of the water will make a very great difference in the tests you obtain, which will, therefore, have to be reduced to standard temperature, for which see text books. If the wire to be tested is neither armored or leaded, the iron tank itself must be used as a return. But if only a wooden tank or a river or pond is available, "earth" must be made with an earth plate of copper or tin of at least 25 square feet of surface soldered to the return galvanometer lead. In any case, scrupulous care must be taken to keep the free end of the cable dry, for which purpose it is best to hang it up by a line from the ceiling, so that it will not be able to run back into the tank and where it will be out of reach. The line must also be dry and made fast to the cable some three or four feet from the end.

The matter of temperature is of great importance in all kinds of tests. It is not always safe to take the common air temperature surrounding it, as being that of the cable, unless it has been laid underground or otherwise sheltered for at least a week.

For instance, a reel of cable which has been in the sun all day will test down very low, whilst if tested at sunrise after an all night exposure to cold, it will test up perhaps 10 times as high.

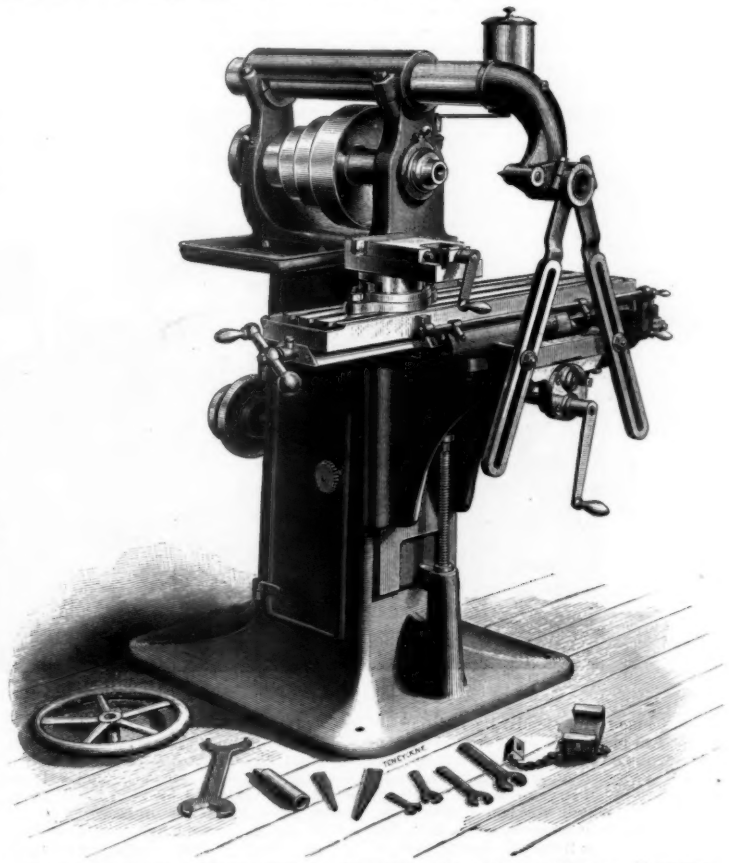
In round numbers, every increase of 10 degrees Fahrenheit, will reduce the insulation one-half. Insulation tests are, therefore, of but little use, unless first the actual temperature of the cable itself is known at the time of testing, and, secondly, unless the test is reduced to standard temperature.

When much of a similar kind of work has to be done, it is often very advantageous to be able to get a definite deflection, such as 528, where feet have to be reduced to miles, or 333⅓ or 500 in the case of capacity measurements with a condenser of ⅓ or ⅙ microfarads.

Usually this cannot be done without moving the magnets, a process involving rather a waste than an economy of time.

The simplest method is to slide your scale towards or from your galvanometer, which allows you to secure any desired deflection with absolute precision.

Such constants will save you a lot of fatiguing trouble and calculation.



BROWN & SHARPE MANUFACTURING COMPANY'S NO. 4 PLAIN MILLING MACHINE.
(SEE PAGE 334.)

—— The Congregational church at Rutland, Vt., has recently been remodeled, redecorated and refurnished, and has added the pleasant feature of electric lighting to its numerous improvements. The electric construction was executed by the Rutland Electric Light Company, the entire lighting effect being planned by the president of that company, Mr. M. J. Francisco. It reflects much credit upon him. About 250 lights are installed.

ELECTRIC LIGHT NEWS

—— Holly, Mich., needs electric lights.

—— De Witt, Neb., is to have electric lights.

—— Boone, Ia., is now making a move for electric lights.

—— Ipswich,. Mass., is considering the question of electric lights.

—— There is some talk of putting in an electric light at Vacaville, Cal.

—— The matter of electricity for Fort Smith, Ark., is being agitated.

—— Calvert, Tex., will have electric lighting for its streets in the near future.

—— The prospects of lighting Rathdrum, Wash., by electricity seem very good.

—— Bergen, Wis., will put in a system of electric street lighting before long.

—— Hanover, Pa., proposes to issue town bonds to purchase an electric light plant.

—— Abingdon, Ill., is considering the subject of electric lighting for its streets.

—— Westfield, N. Y., is agitating the question of an electric plant for street lighting.

—— Malden, Mass., is seriously considering putting up a municipal gas and electric light plant.

—— The committee on lighting of Avon, Mass., has reported in favor of electric lighting for its streets.

—— M. & S. Pierce, of Honeoye Falls, N. Y., contemplate lighting their mill by electricity this year.

—— The proposition to light the borough of North Wales by electric light is very favorably considered.

—— The Edison Electric Illuminating Company, of West Chester, Pa., has declared a five per cent. dividend.

—— The National Electric Company, of Eau Claire, Wis., have closed a contract for lighting the new court house at Kansas City.

—— Alexander Wiltsie has been elected secretary and superintendent of the Catskill, N. Y., Illuminating and Power Company.

—— The Newark Electric Light and Power Company has declared its regular quarterly dividend of one and one-half per cent.

—— The Edison General Electric Company have moved into their new Pittsburgh building, on Wood street corner of Diamond. It is a fine structure.

—— It is stated that the Thomson-Houston Company is planning to erect another factory on Centre street, West Lynn, in its present group of buildings.

—— D. W. Hughes has resigned as president of the Chattanooga Electric Light and Power Company. D. J. O'Connell was elected to fill the vacancy.

—— All the capital of the Berwyn Water, Fuel and Light Company, of Berwyn, Ill., has been subscribed. They propose to install a plant shortly for lighting.

—— The Brush Electric Company, of Cleveland has brought suit against the city of Chicago for infringement of their double carbon arc lamp patents.

—— Clark Bros., machinists, of Belmont, N. Y., contemplate putting in an electric light plant at Wellesville, N. Y., to furnish lights for the streets and business places.

—— The following committee was appointed by the town of Hudson, Mass., to investigate the matter of lighting for the streets: Geo. P. Keith, J. P. Clare, Chas. H. Hill, F. W. Millay, F. P. Glazier.

On the Law of Hysteresis.

A PAPER READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, JANUARY 19, 1892, BY CHARLES PROTEUS STEINMETZ.

(*Continued from page 325.*)

Magnetometer Tests.

The method used in the foregoing has the great advantage that

1. It allows the taking of a greater number of readings, over a wide range of magnetization, in a short time, by mere simultaneous instrument readings, and thereby reduces the probable error by increasing the number of observations.

2. It allows the use of electro dynamometers as the most reliable electric measuring instruments.

3. It deals with larger amounts of energy, counting by watts or even hundreds of watts, whereby a much greater accuracy can be reached than by the ballistic galvanometer.

4. It measures the hysteresis under the influence of an harmonically, and not suddenly, varying magneto-motive force, that is, under the same conditions, where it becomes of importance for practical engineering.

But it has the great disadvantage that it can be used only for testing sheet iron or other thoroughly laminated iron, where eddies are either inappreciable or can be calculated also. For testing solid iron and steel pieces, this method cannot be used, because of the tremendous amount of eddies which would flow in a solid piece of iron.

To determine the hysteretic loss of energy in steel and cast iron the Eickemeyer differential magnetometer was used. Complete description of this instrument and its use is to be found in the *Electrical Engineer*, March 25, 1891, wherefrom is taken a part of the following description. In Fig. 7 is shown this instrument, which I shall be glad to show in our factory to anybody who is interested in it. In Figs. 8 and 9 are diagrams of its action.

The principle of this instrument resembles somewhat the principle of the well known differential galvanometer applied to the magnetic circuit. In Fig. 8, suppose F_1 and F_2 were two electromotive forces, connected in series; for instance, two cells of a battery, x and y the two resistances which we want to compare. Either resistance x and y is shunted, respectively, by a conductor a and b of equal resistance, which influences a galvanometer needle, G, in opposite directions, but with equal strength.

Then the zero position of the needle G shows that the electric current c_a, flowing in a, is equal to the current c_b in b. But let the current in x be c_x, and in y, c_y; then we must have $c_a + c_y = c_b + c_x$, because the currents c_a and c_y are the two branches of the same integral current as c_b and c_x.

Therefore, if $c_a = c_b$, then $c_x = c_y$.

But if $c_a = c_b$, and $a = b$, the difference of potential at the ends of a (or, what is the same thing, y) is equal to the difference of potential at the ends of b or x, and, therefore, the current in x and y and the potential differences being the same, it follows that $x = y$.

That is, this method of connection allows us to compare an unknown resistance x with a standard resistance y.

Now, instead of "electric current," say "magnetic current" or "number of lines of magnetic force"; instead of "electromotive force" or "potential difference," say "magneto-motive force"; and instead of "electric resistance," say "magnetic resistance," and we have the principle of this instrument.

Its magnetic circuit consists of two pieces of best Norway iron, ⊔ shaped, shown in the illustration of the complete instrument, Fig. 7, and in the diagram Fig. 9, at F_1 and F_2. The middle portion is surrounded by a magnetizing coil C. Therefore, if coil C is traversed by an electric current, the front part s_1 of the left iron piece becomes south and the back part n north polarity. The front part of the right iron piece n becomes north and the back part south; and the lines of magnetic force travel in the front from the right to the left, from n_2 to s_1; in the back the opposite way, from the left to the right, or from n_1 to s_2, either through the air or, when n_2 and s_1 or n_1 and s_2 are connected by a piece of magnetizable metal, through this and through the air.

In the middle of the coil C stands a small soft iron needle with an aluminum indicator, which plays over a scale K, and is held in a vertical position by the lines of magnetic force of the coil C itself, deflected to the left by the lines of magnetic force traversing the front part of the instrument from n_2 to s_1, deflected to the right by the lines traversing the back from n_1 to s_2. This needle shows by its zero position that the magnetic flow through the air in front from n_2 to s_1 has the same strength as the magnetic flow in the back from n_1 to s_2 through the air.

Now, we put a piece of soft iron x on the front of the instrument. A large number of lines go through x, less through the air from n_2 to s_1, but all these lines go from n_1 to s_2 through the air at the back part of the magnetometer, the front part and back part of the instrument being connected in series in the magnetic circuit. Therefore the needle is deflected to the right by the magnetic flow in the back of the instrument.

Now, we put another piece of iron, y, on the back part of the instrument. Then

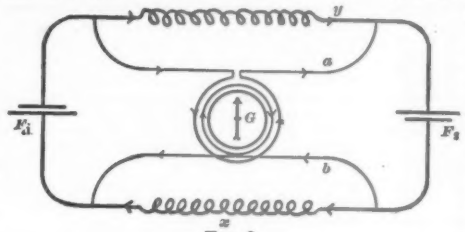


Fig. 8.

equilibrium would be restored as soon as the same number of lines of magnetic force go through x as through y, because then also the same number of lines go through air in the front as in the back. As will be noted, the air here takes the place of the resistances a and b, influencing the galvanometer needle G, as in the diagram, Fig. 8.

The operation of the instrument is exceedingly simple and is as follows: Into the coil C an electric current is sent, which is measured by the ammeter A and regulated by the resistance switch R. Then the needle, which before had no fixed position, points to zero.

Fig. 7.

Now the magnetic standard, consisting of a cylindrical piece of Norway iron of 4 cm.² cross-section and 20 cm. length is laid against the back of the instrument, with both ends fitted into holes in large blocks of Norway iron, A_3, A_4, which are laid against the poles S, N of the magnetometer, so that the transient resistance from pole-face to iron is eliminated.

The sample of iron that we wish to examine is turned off to exactly the same size, 4 cm.² cross-section and 20 cm. length, and fitted into blocks A_1 A_2 in front of the magnetometer. Then so many fractional standard pieces of Norway iron are added in front, that the needle of the instrument points to zero. This means that the 4 cm.² Norway iron in the back carry, under the same difference of magnetic potential, the same magnetism as the 4 cm.² of the examined sample plus the x cm.² of fractional standard, added in the front. Hence, 4 cm.² of the examined sample are equal in conductivity (susceptibility) to $(4-x)$ cm.² of Norway iron, and the susceptibility of this sample is $\frac{4-x}{4} \times 100$ per cent. of that Norway iron, for that difference of magnetic potential, viz., magnetization that corresponds to the magnetometer current.

To get absolute values, the instrument has been calibrated in the following way: In the front and in the back the magnetic circuit of the instrument has been closed by 4 cm.² Norway iron. Then another piece of iron, and of any desired size, has been added in the front. This piece, y, carrying some magnetism, also, equilibrium was disturbed. Then through a coil of exactly 110 turns, surrounding this piece y, an electric current i was sent and regulated so that equilibrium was restored. In this case no magnetism passed through y, or, in other words, the magneto-motive force of the current i; $110\,i$ ampere turns is equal to the differences of magnetic potential between the pole-faces of the instrument. In this way, for any strength of current in the main coil C of the magnetometer, the difference of magnetic potential produced thereby between the pole-faces of the instrument was determined and plotted in a curve, for convenience, in ampere turns per cm. length.

Now, the Norway iron standard was compared on the magnetometer with sheet iron, of which, from tests with low frequency alternating currents, the magnetization corresponding to any magneto-motive force was known, and therefrom derived the magnetic characteristic of the Norway iron standard and plotted in a curve also.

In the way explained before, the iron sample that was to be determined, was balanced by the magnetometer by Norway iron, thereby giving it susceptibility in per cent. of that of the Norway iron standard, the magnetometer current read, from the curves taking the magneto-motive force corresponding thereto—denoted with F—and the magnetization of the Norway iron, corresponding to this magneto-motive force, F, and from the determined percentage of susceptibility of the examined sample, the magnetization B of this sample corresponding to the magneto-motive force F.

With this instrument a number of magnetic cycles of different samples of steel and cast iron were determined.

First, a powerful alternating current was sent through the magnetometer and around all the iron pieces used, to destroy any trace of permanent or remanent magnetism.

Then the examined sample was laid against the front, the standard against the back of the magnetometer, balanced, and a larger number of magnetic cycles completed between given limits, for instance, + 95 and — 95 ampere turns magneto-motive force per cm. length. Then readings were taken

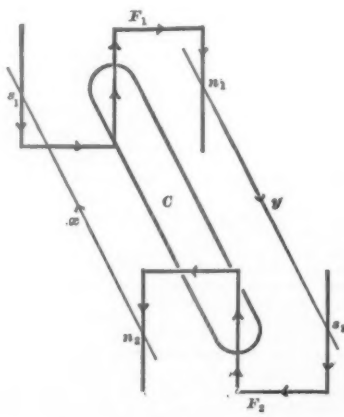


Fig. 9.

from maximum magneto-motive force + 95 down to zero, and again up to the maximum — 95, down over zero and up to + 95, thereby completing a whole magnetic cycle, and then of a second magnetic cycle, a few readings were taken as check for the first one.

In this way for different magneto-motive forces the curve of hysteresis was found and by measuring its area the loss by hysteresis determined.

The further calculation was done in a somewhat different way. Generally the number of cycles was not large enough to determine conveniently the exponent by analytical methods.

Therefore, the law of the 1.6 motive power,

$$H = \eta B^{1.6}$$

was assumed as true, and for each cycle from the known values of H and B determined the co-efficient η.

If for different cycles the values of η agreed, this would prove the assumption, the correctness of the law of 1.6th power, while a disagreement would disprove it.

In the following for a number of samples the magnetic cycles are given:

F = magneto-motive force in ampere turns per cm. length.

B_r and B_d = the intensity of magnetization, in kilolines, corresponding to magneto-motive force F, for the rising and the decreasing branch of the magnetic curve.

The area of the looped curve, representing the loss of energy by hysteresis is derived by adding the values of B^d and substracting therefrom the sum of the values B_r, B_d and B_r being given from five to five ampere turns, or .5 absolute units, the difference of the sums of $B_d - B_r$ just gives the loss by hysteresis in ergs per cycle.

Cast-Steel, Annealed and Hardened. Fig. 10: Table VII.

Of one kind of steel two test pieces were cast, at the same casting, turned off to standard size and, by comparing them in the magnetometer, found to be exactly alike.

Then the one piece was hardened, the other left annealed.

Magnetometer tests gave the magnetic cycles shown in Table VII.

Hence, when *annealed*, the hysteretic loss is $H = .008\ B^{1.6}$; when *hardened*, $H = .029\ B^{1.6}$, and calculated by means of these formulæ, we derive H = 48,400, 77,500, 101,500, 34,730, 45,100 and $H_{calc.} - H_{obs.} = +100 - 300 + 400 - 70 + 100 =$ per cent. of $H + .2 - .4 + .4 - .2 + .2$.

In Fig. 10 are drawn some of the magnetic curves for both samples.

It is especially interesting to note that though the chemical constitution of both samples is exactly the same, their magnetic behavior is entirely different, so that the *magnetic* properties of iron seem to be determined much more by its *physical* than its *chemical* constitution. (See Table VIII.)

Average $\eta = .001195 \sim .012$

Herefrom, $H = .012\ B^{1.6}$

H = 14,620 19,520 25,140 30,020

$H_{calc.} - H_{obs.} = +20 - 380 + 140 + 420 =$ per cent. of $H + .1 - 1.9 + .6 + 1.4$.

With regard to hysteresis, this kind of cast steel is 50 per cent. worse than the annealed cast steel No. 1, but, still twice as good as the hardened sample. But, magnetically, it is poor—that is, of low susceptibility, giving for 40 ampere turns magneto-motive force per centimetre length only ~ 6,600 lines of magnetic force per square centimetre, while the annealed steel gives ~ 14,000—that is, more than twice as many, and even the hardened steel gives more, ~ 8,000.

TABLE VII.

	Hardened.				Annealed.			
F	B_r	Bd	B_r	Bd	B_r	Bd	B_r	Bd
0	± 5.0		± 7.0		± 7.8		± 6.6		± 8.6	
5	−4.4	+5.6	−6.4	+7.5	−7.3	+8.2	−1.4	+10.7	−2.6	+11.3
10	−3.7	6.1	−5.6	7.9	−6.8	8.6	+3.4	11.9	+3.7	12.3
15	−2.7	6.5	−4.4	8.2	−5.6	8.9	8.4	12.5	8.4	12.7
20	0	6.9	−1.9	8.6	−2.3	9.2	10.9	12.8	10.8	13.0
25	+3.9	7.3	+1.9	9.0	+ .4	9.5	12.2	13.1	12.0	13.3
30	5.5	7.6	4.2	9.3	2.5	9.8	13.0	13.4	12.7	13.6
35	6.7	8.0	6.2	9.6	4.2	10.1	13.5	13.7	13.2	13.9
40	7.7	8.3	7.6	9.9	5.8	10.4	13.9	14.0	13.5	14.2
45	8.5		8.7	10.2	7.2	10.7	14.1		13.8	14.5
50	(44.5.)		9.6	10.5	8.4	11.0	(44.5.)		14.1	14.7
55			10.4	10.8	9.6	11.2			14.4	15.0
60			10.9	11.1	10.4	11.5			14.7	15.2
65			11.4		10.9	11.8			15.0	15.4
70			(64.5.)		11.4	12.0			15.3	15.6
75					11.9	12.3			15.6	15.8
80					12.2	12.5			15.8	16.0
85					12.5	12.7			16.0	16.1
90					12.8	12.9			16.2	16.3
95					13.0	13.1			16.4	16.5
100					13.2	13.3			16.6	
105					13.4	13.4			(101.0.)	
110					13.5					
					(108.0.)					
H = obs.	48,300		77,800		101,100		34,800		45,000	

Herefrom, as co-efficient of hysteresis, was found

η = .02494 | .02512 | .02490 | .007997 | .007962

Average, η = .024987 ~ .025 | η = .007980 ~ .0080

TOOL STEEL. FIG. 12: TABLE IX.

	I.		II.			III.	
F	B_r	Bd	B_r	Bd	F	B_r	Bd
0	± 8.3		± 9.6		50	13 9	16.8
5	−5.7	+10.2	−7.5	+11.2	55	16.4	17.0
10	+1.2	11.6	−2.0	12.4	60	16.9	17.4
15	7.4	12.6	+7.2	13.5	65	17.3	17.7
20	11.0	13.4	10.9	14.2	70	17.7	18.0
25	12.6	13.8	12.4	14.8	75	18.0	18.2
30	13.5	14.2	13.3	15.3	80	18.3	18.4
35	14.2	14.5	14.0	15.7	85	18.6	18.7
40	14.8		14.7	16.0	90	18.8	
45	(39.0.)		15.3	16.4		(90.0.)	
H = obs.	44,400					64,000	
η =	.00944					.00928	

Average, η = .00936

hence H = calc. 44,000 | 64,600

Δ = −400 | +600

= ± 1.0 per cent.

TABLE X.

	I.		II.			II.	
F	B_r	Bd	B_r	Bd	F	B_r	Bd
0	± 2.5		± 3.5		50	6.8	7.9
5	−1.7	+3.2	−2.7	+4.1	55	7.3	8.2
10	− .6	3.9	−1.7	4.7	60	7.8	8.6
15	+ .9	4.4	− .2	5.2	65	8.2	8.9
20	2.6	4.9	+1.6	5.7	70	8.6	9.2
25	3.8	5.4	3.0	6.1	75	9.0	9.4
30	4.6	5.8	4.0	6.5	80	9.4	9.7
35	5.2	6.1	4.9	6.8	85	9.7	9.9
40	5.8	6.4	5.5	7.2	90	10.0	10.1
45	6.3	6.6	6.1	7.6	95	10.3	
50	6.8					(95.0.)	
	(50.0.)						
H= obs.	22,300 ergs		42,000 ergs				
η =	.01647		.01589				

Average, η = .01616

H = calc. 22,000 | 42,800

$H - H$ = calc. obs. − 300 | + 800

= per cent., − 1.5 | + 1.9

MAGNETIC IRON ORE. FIG. 14: TABLE XI.

In the following are given the magnetic curves of a piece of magnetic iron ore, apparently pure Fe_3O_4 of the dimensions, 1 in. x 1 in. x $2\frac{1}{2}$ in.

TABLE XI.

MAGNETIC CHARACTERISTIC.

F in ampere turns per centimetre length of magnetic circuit.

B in lines of magnetic force per square centimetre.

F	B	F	B	F	B
10	750	70	2930	140	3770
20	1510	80	3080	160	3930
30	2000	90	3220	180	4070
40	2320	100	3350	200	4200
50	2560	110	3470	220	4310
60	2760	120	3580	240	4400

marked knee at all, but a steady curvature of low remanent magnetization, but with regard to coercitive force ranging between 1 and 2.

The curve of the magnetic iron ore shows all the characteristics of a cast iron curve.

Having derived, now, a larger number of values of the hysteretic co-efficient η for different kinds of iron and other material, we shall put them together for comparison in Table XI.

It is remarkable, in these results, that for several samples of each set the quotient $\frac{\eta}{C}$ gives almost exactly the same value, while other values disagree therefrom. From this average value of $\frac{\eta}{C}$ are calculated the values of the coercitive force C of sheet iron, given in the brackets.

For convenience, in the following table are given the values W of consumption of energy in watts per cubic inch, for 100 complete periods (magnetic cycles) per second, and for the magnetization of H lines of force per square inch, giving as co-efficient of hysteretic resistance the value

$\gamma = 8.3 \times 10^{-6}\ \eta$

In Table XII., I have given a number of experimental values of the consumption of energy by hysteresis, and believe to have shown that this consumption of energy can fairly well be expressed by the empirical formula,

$H = \eta\ B^x$

where the exponent x is equal, or at least very nearly, to 1.6, and the co-efficient η a constant of the material, which ranges from .002 up to .025 and more, and may possibly have a slight dependence upon the *velocity*.

(To be continued.)

TABLE XII.

CYCLIC MAGNETIZATION.

	I.		II.			II.	
F	B_r	Bd	B_r	Bd	F	B_r	Bd
0	± 900		± 1020		130	3640	3740
10	0	+1520	− 200	+1660	140	3730	3820
20	+1200	1920	+1000	2020	150	3820	3900
30	1800	2230	1750	2280	160	3910	3980
40	2160	2500	2150	2520	170	3990	4050
50	2450	2700	2390	2710	180	4050	4110
60	2670	2850	2610	2880	190	4120	4170
70	2850	3000	2800	3020	200	4190	4230
80	3020	3120	2980	3150	210	4250	4280
90	3190	3250	3140	3280	220	4320	4340
100	3340	3360	3280	3410	230	4360	4370
110	3440		3410	3530	240	4400	
120	(106.)		3530	3640		(240.)	

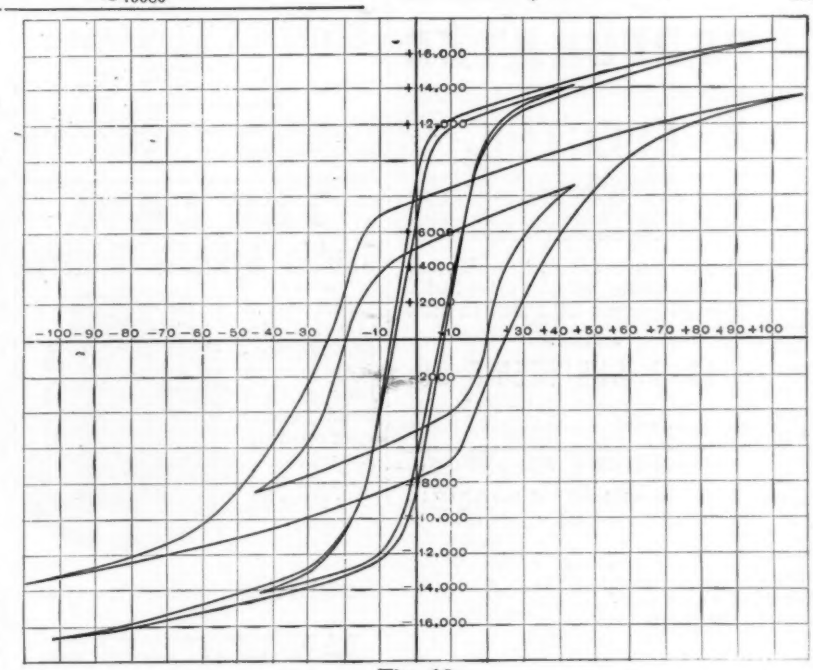


Fig. 10.

H = obs. 9,340 ergs | 13,780 ergs

η = .02049 | .02041

Average, η = .02045

Curve of hysteresis,

$H = .02045\ B^{1.6}$

H = calc. 9,320 ergs | 13,810 ergs

$H - H$ = calc. obs. − 20 ergs | + 30 ergs

= − .2 per cent. + .2 per cent.

As seen, the co-efficient of hysteresis of magnetic iron ore, η = .020, ranges between that of cast iron, η = .016, and of hardened steel, η = .025.

The magnetic conductivity is, approximately, 20 per cent. of that of wrought iron.

In Fig. 15 is given a comparisons of the hysteretic curves of hardened steel, annealed steel, cast iron, magnetic iron ore in the same size.

This figure shows well the three characteristic forms of hysteretic curves shown in Table XI.

1. The hardened steel curve of high coercitive force, has the bend or "knee" on the *negative* side, so that for zero magnetomotive force the "remanent" magnetism is still in the saturation part of the curve—that is, in stable equilibrium; therefore perfectly magnetizable.

2. The soft iron curve, with the bend on the *positive* side, so that for zero magnetomotive force the "remanent" magnetism, though still very high, is already below the range of saturation on the branch of unstable equilibre. Therefore the remanent magnetism is very unstable and easily destroyed, the more as the coercitive force is very small.

3. The cast iron curve, which has no

ANOTHER SAMPLE OF CAST STEEL OF LOW SUSCEPTIBILITY. FIG. 11: TABLE VIII.

F	B_r	Bd	B_r	Bd	B_r	Bd	B_r	Bd
0	± 2.5		± 2.8		± 3.1		± 3.4	
5	−1.5	+3.4	−1.9	+3.6	−2.1	+3.9	−2.7	+4.2
10	+ .6	4.1	− .4	4.3	− .6	4.6	−1.3	4.8
15	2.7	4.6	+2.7	4.9	+2.2	5.2	+2.3	5.4
20	3.9	5.1	4.0	5.5	4.2	5.8	3.8	5.9
25	4.7	5.6	4.9	6.0	5 1	6.2	4.8	6.4
30	5.5	6.0	5.6	6.4	5.7	6.6	5.5	6.7
35	6.2	6.3	6.2	6.7	6.1	6.9	6.0	7.1
40	6.38		6.6	7.0	6.6	7.2	6.5	7.4
45	(37.0.)		7.0	7.3	7.0	7.5	7.0	7.7
50			7.4	7.5	7.4	7.8	7.4	7.9
55			7.64		7.8	7.1	7.8	8.2
60			(52.0.)		8.1	8.4	8.1	8.5
65					8.4	8.6	8.4	8.8
70					8.7	8.8	8.7	9.0
75					8.95		9.0	9.2
80					(75.0.)		9.3	9.5
85							9.5	9.6
90							9.8	9.8
95							10.0	
							(95.0.)	
H = obs.	14,600		10,900		25,000		29,600	
η =	.0119		.0122		.0119		.0118	

Fire at Roebling's Factory.

The braiding building of the John A. Roebling's Sons Company wire works was burned the night of February 4. It was a three-story brick, and in it braid was put on telephone and electric light wires. The loss on the building and its contents is estimated at $150,000.

Interesting Experiments With Ozone.

In some recent researches into the therapeutic and physiological effects of ozone, by MM. Labbé and Oudin, which are recorded in the *Comptes Rendus*, a curious experiment was made. An ozone generator was used, which consisted of a closed glass-tube containing rarefied air (which acts as one of the poles), surrounded by a tube, on the inner surface of which was a metallic thread. The space between the tubes was three to four millimetres, and across this space the sparks which produces the ozone were passed. Ten of these tubes were used, each being about 800 millimetres long; they were placed in a laboratory of 300 cubic metres air space, and were actuated by an alternating current from a Gramme machine with a potential of 7,000 volts. The tubes having been placed vertically, the slight rise of temperature resulting from the discharge caused a continuous upward current of ozonized air which mixed with the unaltered air of the laboratory. After about a quarter of an hour the laboratory was filled with a bluish cloud of aluminium or aluminium oxide, and direct experiment showed that the electric discharge caused the volatilization of weighable quantities of aluminium from the electrodes.

KINDRED INTERESTS

Mr. M. J. Francisco, president of the Rutland, Vt., Electric Light Company, has just finished the arrangement of a very handsome window display at the office of that company. It is an Arabian Night's effect.

The Hill Clutch Works, of Cleveland, O., report having recently closed two very nice contracts in St. Louis, one with the Benton and Bellefontaine Railway Company and the other with the St. Louis and Suburban line.

The National Carbon Company, of Cleveland, Ohio, send us a calendar which will be very handy for the central station manager. On each slip is given a moonlight schedule for the month, good anywhere in the United States. Send for it.

The Electric Fan is coming into use in the United States Navy. The Crocker-Wheeler Electric Company, we are informed, has just placed four of its perfected fan outfits in the turrets of the new United States steamer "Miantonomoh," to blow the smoke away from the guns.

J. W. Parker & Company, Philadelphia representatives of the Ball Engine Company, Erie, Pa., are setting up a 200 horse-power Ball engine at the Columbia Electric Light Company's station in that city. A number of new improvements are embodied in this engine.

Messrs. Hatzel & Buehler, 29 West Twenty-sixth street, as agents for the Detroit dynamos and motors in New York, have issued a very excellent pamphlet containing many useful tables, much general information of value on the transmission of power, electric lighting, etc. This enterprising firm has made a good record.

Alexander, Barney & Chapin, New York, have voted an increase of their stock by the issue of $50,000 eight per cent. preferred stock. Their business has increased so wonderfully that more money was necessary for its purposes. A good portion of this increased capital was subscribed for at the meeting of the stockholders at which the increase was voted, and the whole new issue will probably soon be taken.

The Interior Conduit and Insulation Company, of New York, are making large shipments of their new Johnson switches to their agents and the principal central stations in the United States. They are already some 30 days behind time in their orders, one illuminating company alone having ordered 1,100 of their well known switches in two days. The company has in preparation a handsome illustrated catalogue setting forth the good qualities of this switch. This catalogue will be issued, together with a revised edition of their well known No. 4 catalogue, in the course of the next 10 days or two weeks.

J. H. Bunnell & Company, 76 Cortlandt street, New York, have sent out the following notice:

"For the protection of the electrical trade in general, we beg to notify all parties interested that suits in our behalf are now being prosecuted against infringements of patents on the Burnley dry battery. All persons making or selling dry batteries which in any respect infringe the Burnley patents, under which we are sole licensees, will be held liable for the full amount of damages arising from such infringement, in either manufacturing or selling."

There is a hearing now proceeding at the office of W. H. C. Andrews, 2 Wall street, before a United States court official, in the matter of evidence in suit against the Manhattan Electrical Supply Company, on account of the Burnley battery patents.

The Hunt Engineering Company, 126 Liberty street, New York, was reorganized on February 1. Mr. J. M. Bowen, of Brooklyn, well known in business circles as an energetic, successful financier and capitalist, has purchased the balance of the treasury stock of the company, has been elected treasurer, and will have control and management of the finances. Of the other officers of the company, Mr. George W. Hunt retains the presidency and Mr. Albert E. Rich continues secretary and general manager. Mr. H. C. Willis, formerly of the firm of T. F. Hunter & Company, 83 Church street, well known to all connected with the electrical supply business as an energetic and pushing salesman, will have charge of the supply department. New quarters have been leased for the manufacturing of their many electrical devices, which are meeting with a ready sale, and we hope for them a successful year's business.

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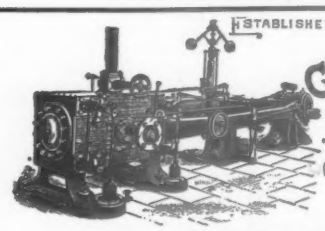

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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON JANUARY 26, 1892.

457,773 Regulation of electric circuits; Frank B. Rae, Detroit, Mich., assignor to the Detroit Electrical Works, same place.

467,774 Electric tell-tale for tanks; Charles Reuter and George Rollmann, Brooklyn, N. Y.

467,833 Magnetic separator; Francis H. Richards, Hartford, Conn., assignor of two-thirds to Roswell M. Fairfield, Holyoke, and Oscar S. Greenleaf, Springfield, Mass.

467,884 Station indicator; Ruben B. Ayres, New York, N. Y., assignor to Aaron L. Ayres, same place.

467,891 Electric wire tapper; Gustave S. Neu, New York, N. Y.

467,897 System of electrical distribution; Nelson W. Perry, Cincinnati, O.

467,901 467,902 Test circuit for multiple switchboards, Charles E. Scribner, Chicago, Ill.

FEBRUARY 2, 1892.

467,917 Telephone holder; James A. Christy, San Francisco, Cal., assignor of part to Bernard Schrafl and F. E. Wait, same place.

467,919 Electric cut-out; Albert L. Clough, Manchester, N. H.

467,924 Electric motor; John W. Darley, Jr., Baltimore, Md.

467,940 Trolley wire hanger. 467,941 467,942 Insulator; Charles T. Lee, Boston, Mass., assignor of one-half to the Gould & Watson Co., same place.

467,958 Incandescent lamp socket; William L. Silvey, Lima, O.

467,969 Electric railway motor; Henry M. Byllesby, St. Paul, Minn.

467,982 Incandescent electric lamp. 467,983 Incandescent lamp socket; David H. Piffard, Piffard, N. Y.

467,985 Electric signal for mine shafts; Frederick W. Bacorn, Marysville, Mont.

468,020 Electrical measuring instrument and current direction indicator; James J. Wood, Fort Wayne, Ind.

468,086 Electric wire coupling; William B. Lillard, New Orleans, La.

468,099 System of electrical distribution. 468,100 Electric elevators; Harry W. Leonard, New York, N. Y.

468,101 Cut-out; John B. Murphy, Cincinnati, O.; Mary J. Murphy, administratrix of said John B. Murphy, deceased.

468,107 Electric signal system; Howard F. Eaton, Quincy, Mass.

468,119 Electric switch; Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Co. of Connecticut.

468,120 Method of and means for interrupting electric currents. 468,121 Dynamo-electric machine. 468,122 System of electrical distribution; Elihu Thomson, Swampscott, Mass.

468,123 System of electrical distribution; Elihu Thomson, Swampscott, and Edwin W. Rice, Jr., Lynn, Mass.

468,125 Electric switch; Augustus Wright, Providence, R. I.

468,128 Electric motor regulation; Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Co. of Connecticut.

468,148 Process of separating aluminium; Chas. S. Bradley, New York, N. Y.

468,159 Device for raising and lowering suspended electric lights; Solon M. Terry, Pittsfield, Mass., assignor of one-half to Cornelius E. Terry, same place.

468,160 Railway switch and signal interlocking mechanism; John W. Thomas, Jr., Nashville, Tenn.

468,163 468,164 468,165 Electric railway. 468,166 Conduit electric trolley; Malone Wheless, Nashville, Tenn.

468,170 Electrical annunciator; William Ebert, Chicago, Ill.

468,172 Electric fare register; Willard H. Gilman, Boston, assignor to Edward P. Shaw and Richard S. Dodge, Newburyport, Fred. P. Harlow, Medford, and Charles Follen Adams and Emery O. Bicknell, Boston, Mass.

468,185 Illuminating sign; Lawrence J. Webster, Boston, Mass., assignor to Bouvé, Crawford & Co., of Massachusetts.

468,186 Electric light tower; Carlton A. Beardsley, Detroit, Mich.

468,246 Telephone receiver; Elwood A. Grissinger, Mechanicsburg, Pa.

468,253 Electric elevator; Albert Neuburger, Kansas City, Mo.

468,260 Regulator for electric current generators; Gustav Pfannkuche, Cleveland, O., assignor to the Brush Electric Co., same place.

468,281 Cut-off for telephones; Edwin Cann, Winnipeg, Canada.

468,283 Means for moving and grinding turning, engraving or planing tools; George M. Guerrant, New York, N. Y., assignor to J. Turner Morehead, Leaksville, N. C.

468,293 Connector for electric wires; Clyde J. Coleman, Chicago, Ill., assignor of one-half to Albert F. Wineman, same place.

468,314 Conduit for electric or cable roads; Clarence H. Bates, Minneapolis, Minn.

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